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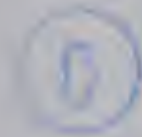


THE UNIVERSITY OF ALBERTA

TEACHERS' RATING OF LEGIBILITY IN HANDWRITING

by

Gordon A. Orlick



A THESIS

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The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies for acceptance, a thesis entitled Teachers' Rating of Legibility in Handwriting submitted by Gordon A. Orlick in partial fulfilment of the requirements for the degree of Master of Education.

ABSTRACT

The purpose of this study was to determine which of the factors of letter formation, spacing, slant and legibility are the best predictors of teachers' rating of children's handwriting and to investigate the relationship between legibility and the internal elements of letter formation, spacing and slant. The study also was designed to investigate whether or not teachers usually rate children's handwriting using legibility as the major criterion.

The data for this study were derived from the handwriting specimens of ninety subjects selected randomly from a handwriting population of 262 grade five students. To obtain an adequate number of judgments, thirty teachers from grades four, five and six in the Edmonton Public School System were invited to judge the handwriting specimens. Using a continuum of handwriting quality and the principles of Q-Methodology, the judges rated the ninety handwriting specimens for general appearance, spacing, letter formation, slant, and legibility in that order, and during five different sessions.

The raw data were transferred to IBM cards for statistical treatment. The analyses of the data proceeded in three steps: (1) deriving the means of the thirty ratings for each specimen and for each criterion; (2) finding the correlation coefficients; and (3) subjecting the average ratings to multiple linear regression analyses.

Within the limitations of this study the findings generally indicated that: (1) the factors of letter formation, legibility, spacing and slant, separately and in that order, were significant predictors of teachers' ratings of handwriting; (2) the factors of letter formation,

spacing, and slant, separately and in that order, were significant predictors of legibility; (3) letter formation was a good predictor of teachers' rating of children's handwriting and of legibility.

From the evidence in this study, one could not conclude that general appearance and legibility are the same quality. In this study letter formation was a better predictor of the way teachers usually rate children's handwriting than was legibility. This would seem to illustrate that the teachers studied do not use legibility as the major criterion in evaluating handwriting.

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TABLE OF CONTENTS

CHAPTER		PAGE
I	THE PROBLEM	1
	Statement of the Problem	1
	Definition of Terms	5
	The Design of the Study	6
	Limitations of the Study	7
	The Significance of the Study	8
II	REVIEW OF RELATED LITERATURE	11
	Introduction	11
	The Importance of Handwriting	11
	Handwriting	14
	Goals of Handwriting Instruction	16
	Legibility	18
	Measurement and Evaluation of	
	Handwriting Quality	21
	Research Related to the Study	28
	Summary	34
III	THE PLAN OF RESEARCH	36
	Introduction	36
	The Criteria	36
	The Handwriting Samples	37
	The Writing Task	38
	The Writing Materials	39
	The Rating	40
	The Judges	40

CHAPTER	PAGE
The Judging	40
The Continuum of Handwriting Quality	41
Controls	42
The Questions, Hypotheses and Analysis	44
The Questions	44
The Hypotheses	44
The Method of Analysis	45
Collection of Data	46
The Pilot Study.	46
The Handwriting Specimens	47
Identification of the Population	47
Collection of the Handwriting Samples	47
Selection of the Handwriting Specimens	48
Rating the Handwriting Specimens	49
Selection of the Judges.	49
Directions to the Judges	51
The Oral Instructions to the Judges Part A	51
The Oral Instructions to the Judges Part B.	55
The Warm-up Exercise	55
Judging the Handwriting Specimens	55
The Continuum of Handwriting Quality	57
The Preparation of the Judges	57
The Judgement Session	57
Recording the Data.	58
The Analysis of the Data	65

CHAPTER		PAGE
	Summary	65
IV	THE FINDINGS	67
	Introduction	67
	The Analysis	68
	Correlation Matrix	68
	General Appearance	69
	Legibility	72
	The Subjective Analysis	72
	The Findings	74
	General Appearance	78
	Legibility	81
	Summary	85
V	SUMMARY, CONCLUSIONS AND	
	IMPLICA TIONS	87
	Summary	87
	Conclusions	90
	Implications and Recommendations	94
	Further Research	95
	BIBLIOGRAPHY	97
	APPENDICES	104

LIST OF TABLES

TABLE		PAGE
I	Summary of the Characteristics of Ninety Subjects Selected for Study	49
II	Random Selection and Identification of the Handwriting Specimens	50
III	Summary of Characteristics of the Group of Thirty Judges	52
IV	Latin Square Design for Presentation of Specimen Patterns to Judges	58
V	Random Patterns of the Specimen Cards	59
VI	Correlation Matrix	69
VII	Results of Multilinear Regression Analysis Relating the Prediction Variables (Letter Formation, Spacing, Slant and Legibility) to the Criterion, General Appearance	70
VIII	Results of Multilinear Regression Analysis Relating the Prediction Variables (Letter Formation, Spacing and Slant) to the Criterion, Legibility	73
IX	The Average Ratings of the Handwriting Specimens Ranked from Poorest to Best	75
X	Letter Formation as a Predictor of General Appearance	82
XI	Spacing as a Predictor of General Appearance	82

TABLE		PAGE
XII	Slant as a Predictor of General Appearance . . .	83
XIII	Legibility as a Predictor of General Appearance	83
XIV	Letter Formation as a Predictor of Legibility . .	84
XV	Spacing as a Predictor of Legibility	84
XVI	Slant as a Predictor of Legibility.	85

CHAPTER I

THE PROBLEM

Statement of the Problem

The program of handwriting instruction for elementary schools in the Province of Alberta is based on the assumption that handwriting is a vehicle or tool to facilitate the communication of ideas. The Alberta handwriting program further assumes that legibility is the single most important quality in handwriting.¹

Two interdependent dimensions are important in the teaching of handwriting. The process of handwriting is important from the producer's point of view while the product may be considered from the point of view of the consumer of the writing. The process of writing refers to the numerous variables related to the individual doing the writing. A study of process would involve an examination of factors such as movement, rhythm, and pressure. The product of writing is studied through criteria used by a consumer to determine the quality of handwriting.

As the child progresses through elementary school he learns to write. He is encouraged by means of time for practice, specific periods of instruction, planned programs of development and large collections of appropriate materials to develop his effectiveness in writing.² Effective development of the writing act is necessary so

¹Alberta Government Publication, Interim Elementary Curriculum Guide for Handwriting, Province of Alberta, Department of Education, 1965, p. 5.

²Virgil E. Herrick and Nora Okada, "Teaching Handwriting in

that a child is able to make meaningful written symbols skillfully while concentrating on the substance of his communication.

By striving to produce handwriting of an acceptable quality, the child is attempting to satisfy his scholastic, economic, social and personal needs.³ Therefore the development of handwriting that is easily read is an important objective of education.⁴ The ability to make written symbols is an individual skill and is among the measurable learnings of children.⁵

Handwriting constitutes an important area in the elementary school curriculum and quality in handwriting is a desirable attribute sought after in language arts programs. Many devices and instructional materials have been used by teachers and by school systems to evaluate the quality of children's handwriting. Among materials that have been used to measure and evaluate children's handwriting are scales consisting of several levels of quality. Among the criteria used in establishing handwriting scales are a number of elements that have been used as criteria of quality. The factors that have been used either singly or in various combinations are general merit, readability, letter formation, quality and speed, uniformity of

the United States, "New Horizons for Research in Handwriting, The University of Wisconsin Press, Madison, 1963, p. 30.

³M. S. MacKay, A Study of Handwriting in Division Two, (unpublished M. Ed. thesis, University of Alberta, 1962), p. 1.

⁴Alberta Government Publication, op. cit., p. 5.

⁵Diodoto Bezzi, Standard Manuscript Scales for Grades I, II and III, (unpublished Ed. D. thesis, University of Oklahoma, 1957), p. 6.

slant, alignment of letters, and spacing between letters and words.⁶

Recent handwriting research has been conducted by Herrick and Erlebacher (1961), Rondinella (1963), and Lane and Peltola (1965). Herrick and Erlebacher rejected the attempts to obtain a five or seven level scale for evaluating handwriting and developed a whole population of writing samples as a set of scaled items with known characteristics of legibility, size, and slant. This categorization of each handwriting sample permitted the development of scales making use of various legibility, size and slant combinations.⁷

While stroke, general quality and speed were considered least important in her study, Rondinella found that the majority of teachers are influenced by neatness, height, slant, spacing and writing that can be easily read. However, Rondinella concluded that teachers consider letter formation the dominant criterion in rating penmanship.⁸

Lane and Peltola, using Herrick and Erlebacher's methods of scaling teachers' ratings of legibility, studied left and right handed fourth grade handwriting. One of the findings of this study was that teachers tend to give the highest rating to samples having large and

⁶Virgil E. Herrick and Adrienne Erlebacher, "Evaluation of Legibility in Handwriting," New Horizons for Research in Handwriting, The University of Wisconsin Press, Madison, 1963, pp. 210-211.

⁷Dan W. Andersen, "Handwriting Research: Movement and Quality," Research in Handwriting and Spelling. National Council of Teachers of English, Champaign, Illinois, 1966, pp. 14-15; and Virgil E. Herrick and Adrienne Erlebacher, op. cit., pp. 207-231.

⁸Oreste R. Rondinella, "An Evaluation of Subjectivity of Elementary School Teachers in Grading Handwriting," Elementary English, Vol. XL, May, 1963, pp. 531-532.

well formed letters.⁹

To bring quality to the instructional program in which the child develops his handwriting skill it may be necessary to have a better knowledge of not only what is involved in good handwriting, but also of the evaluation process. The quality of letter formation, spacing, and uniformity of slant have been identified as important factors in determining legibility in handwriting.¹⁰ These qualities are selected from the characteristics of handwriting that have been used as criteria of quality, or legibility, in handwriting scales and also from the findings and conclusions of handwriting research. However, there is uncertainty as to which elements of legibility influence teachers' judgements of handwriting most, and whether the terms general appearance and legibility represent the same qualities. Thus, the purpose of this study is to determine which of the factors of letter formation, spacing, slant and legibility are the best predictors of teachers' usual rating of children's handwriting. The relationship between legibility and the internal elements of letter formation, spacing and slant will also be investigated to discover whether or not general appearance and legibility represent the same qualities in handwriting. Therefore, this study will attempt to answer the following questions:

1. Is there a significant relationship among selected elements of legibility in handwriting: general appearance, letter

⁹Patricia Lane and Bette J. Peltola, "A Study of the Handwriting of Left and Right Handed Fourth Grade Writers," (unpublished Colloquium Paper, Faculty of Graduate Studies, University of Minnesota, 1965), p. 112.

¹⁰Virgil E. Herrick and Adrienne Erlebacher, op. cit., p. 216.

formation, spacing, slant and legibility?

2. What elements of legibility, either singly or in combination, contribute most to teachers' judgements of children's handwriting?
3. Do the terms "general appearance" and "legibility" represent the same qualities in handwriting?
4. Using the criteria suggested in the Interim Elementary Curriculum Guide for Handwriting, do teachers rate children's handwriting the way one would assume they do?¹¹

Definition of Terms:

The relationship among the factors of general appearance, spacing, letter formation, slant and legibility will be investigated in this study. These terms are defined here while the terms "writing," "handwriting" and "quality" will be defined at the time of their introduction in the study.

1. General appearance: For the purposes of this study, general appearance refers to the way in which a teacher usually rates children's handwriting in his own classroom.
2. Spacing: Spacing refers to the space between letters and words in the handwriting specimens.
3. Letter formation: Letter formation refers to the size, shape and stroke of the letters in the handwriting specimens.
4. Slant: Slant refers to the angle which the up or down stroke of the letters make with the line of writing in the handwriting

¹¹Alberta Government Publication, op. cit., p. 5.

specimens.

5. Legibility: In this study legibility refers to the ease with which a sentence can be read.¹²

The Design of the Study

For the purposes of this study handwriting samples were collected from all children in grade five in three schools located in a middle-class attendance area of the Edmonton Public School System. The grade five teachers in each of the selected schools collected the handwriting samples according to specified directions.

From this collection of handwriting samples, ninety handwriting specimens were randomly selected to be evaluated by thirty competent judges. The judges were teachers licensed to teach in Alberta and were teaching in grade four, five or six in the Edmonton Public School System at the time the study was carried out. The judges were invited by the investigator to participate in the study.

Using a continuum of handwriting quality based on Q-sort Methodology for obtaining a distribution of opinions, each judge rated each of the ninety handwriting specimens for each of the following aspects of quality in handwriting: general appearance, spacing, letter formation, slant and legibility. Each judge rated each specimen five times. An average rating, or judgment, was derived for each handwriting specimen for each criterion.

The ratings were analyzed using multiple linear regression models to determine which of the factors of letter formation, spacing

¹²Virgil E. Herrick and Adrienne Erlebacher, op. cit., p. 215.

slant, and legibility were the significant predictors of teachers' rating of children's handwriting. The same statistical analysis was used to investigate whether or not general appearance and legibility represent the same qualities in handwriting.

Limitations of the Study

The following limitations of this study are noted.

1. Within-judge characteristics were not dealt with in this study. The degree to which a judge was able to isolate in his own mind a criterion of quality in handwriting and, using only that referent, rate children's handwriting, determines the validity of the measures used in this study.
2. Teachers of grades four, five and six were judges of handwriting specimens used in this study. Different results might have been obtained for different groups of judges.
3. To avoid any influence or bias that might come from teacher models or memorization of the writing task, the teachers were instructed to discuss the task with the children until the children knew it. Consequently, spelling errors, erasures and smudges appeared in the handwriting specimens. Whereas these defects may be considered normal, they may have prejudiced some judges in their rating of the children's handwriting specimens.
4. The pupils from whom the handwriting samples were collected were representative of the grade five population in a middle-class area of the Edmonton Public School System. Consequently the results cannot be generalized to other

populations.

5. The writing task selected for this study contains all the letters of the alphabet and is easily learned and understood by the children. However, as in Herrick and Erlebacher's study of evaluation of legibility in handwriting, it is questioned whether the length and substance of the writing task produces a truly representative sample of children's handwriting.¹³
6. All the handwriting samples were produced with a ball point pen. However, it is not certain whether all the subjects used the model supplied to the schools by the Edmonton Public School Board. This may have prejudiced some judges in the rating of the handwriting specimens.

The Significance of the Study

While quality of letter formation, spacing, and uniformity of slant have been identified as important factors in determining legibility or quality in previous studies, it is not certain what elements of quality influence teachers' judgements most when rating children's handwriting. In this study of teachers' ratings of legibility in children's handwriting, the investigation is based on five assessments of each of the ninety handwriting specimens by thirty judges. Each assessment of the same handwriting specimens is based on a particular aspect of quality in handwriting.

¹³Virgil E. Herrick and Adrienne Erlebacher, op. cit., p. 231.

Previous studies have used handwriting scales, precise measurement according to generally accepted specifications of size and slant of letters, and have regarded legibility of handwriting specimens as quality. While this study also regards quality of handwriting as legibility, all the judges will rate general appearance, spacing, letter formation, slant, and legibility in this order and in the same manner by placing the randomly selected handwriting specimens on a continuum of handwriting quality. The continuum of handwriting quality used as a device for rating each handwriting specimen consisted of eleven categories of quality ranging from the poorest to the best.

The continuum of handwriting quality is based on the principles of Q-Methodology of rank-ordering objects and then assigning numerals to subsets of objects for statistical purposes.¹⁴ The means of the thirty ratings for each of the ninety specimens, assessed separately for the five aspects of quality in handwriting, were statistically analyzed using multilinear regression models to test significant relationships among them.

Recent handwriting research has investigated the process of handwriting and its effect on the quality in handwriting, the construction of handwriting quality measures, the effects of handedness on legibility, the reliability of teachers' judgements when using quality measures, handwriting style and speed, and teachers' subjectivity in rating children's handwriting. The purpose of this study is to determine what elements of legibility most influence teachers' judgements

¹⁴Fred M. Kerlinger, Foundations of Behavioral Research, Holt Rinehart and Winston, Inc., New York, 1965, p. 581.

of children's handwriting and to investigate whether general appearance and legibility represent the same qualities in handwriting.

If a significant relationship were found among the five aspects of quality in handwriting investigated in this study, if varying combinations of the elements of legibility were found to be significant predictors of teachers' rating of quality in children's handwriting, a better knowledge of what is actually involved in good handwriting may have been determined. Information about handwriting as a product gained from this study may assist in bringing increased quality to the instructional program in handwriting by drawing to the attention of teachers the factors that influence their evaluation of children's handwriting. More effective development of each child's handwriting may result if teachers give specific emphasis to the appropriate criteria of evaluation.

CHAPTER II

REVIEW OF RELATED LITERATURE

Introduction

Compared to the amount of professional opinion available about handwriting there is a lack of recent handwriting research. The Committee on Research in Basic Skills, University of Wisconsin, reported that between 1890 and 1960 about two thousand studies had been reported in the professional literature in the western world. However, most of this research took place during the first thirty years of this century. Almost no attention was given to handwriting during the twenty year period between 1930 and 1950. Since 1950 there has been an increase in research in handwriting.¹

Chapter II reviews the related handwriting literature. It directs attention to the importance of handwriting, the goals of handwriting instruction, legibility, and measurement and evaluation of handwriting quality.

The Importance of Handwriting

The need for good handwriting has been expressed by educators as well as people in business. Cole, a professor of education, comments on present handwriting practices and instruction by stating that, 'No subject in the curriculum is as neglected or as poorly taught, above the first three grades, as handwriting. And in no other subject are the

¹Virgil E. Herrick, New Horizons for Research in Handwriting, University of Wisconsin Press, Madison, 1963, p. xi.

results of instruction less impressive."² O'Brien estimated that:

...commercial errors due to illegible penmanship are costing U. S. businessmen approximately a million dollars a week in scrambled orders, lost time, missent deliveries, clerical mistakes, billing and inventory foulups, and other forms of expensive inefficiency.³

The lack of interest in the importance of handwriting may be due in part to the idea that technology has taken over the function of handwriting. However, among Templin's findings it is noted that, "the pencil, ballpoint pen and fountain pen--in that order are the most commonly used tools."⁴ Templin concluded that "the typewriter has apparently not replaced the pencil."⁵

While most educators generally agree that handwriting is one of the basic subjects in the elementary school, this concept is not always carried out in practice. In 1961, King reported a survey he had conducted to ascertain the degree to which handwriting is being emphasized in our schools today and also to determine the extent to which school administrators are concerned with handwriting programs.⁶

²Luella Cole, "Reflections in the Teaching of Handwriting," Readings in the Language Arts, Anderson et al, The MacMillan Company, New York, 1964, p. 200.

³Robert O'Brien, "The Moving Finger Writes--But Who Can Read?". Saturday Review, July 18, 1959, p. 8.

⁴Elaine Templin, A Comparative Study of Legibility of Handwriting Styles: All Cursive, All Manuscript or Manuscript-Cursive, (unpublished Ph. D. thesis, New York University, 1951), p. 2.

⁵Elaine Templin, "How Important is Handwriting Today," Elementary School Journal, December, 1960, p. 163.

⁶Fred M. King, "Handwriting Practices in Our Schools Today," Elementary English, Vol. XXXVIII, November, 1961, pp. 483-486, 493.

Among his findings, King discovered that 30 per cent of all the school systems surveyed did not use one of the established commercial programs nor had they an organized formal program of their own. He also found that the handwriting materials of two companies were being used by 89 per cent of the cities that have formal handwriting programs and 59 per cent of those reporting feel that a minimum of fifty minutes per week should be devoted to organized formal handwriting lessons. However, about 30 per cent of the systems reporting designated no time spent on formal handwriting instruction. Furthermore, only 9 per cent of the administrators who responded indicated they require some kind of handwriting training when employing teachers.

In a survey of material and of handwriting practices, Herrick and Okada concluded that:

Programs of instruction in handwriting are determined largely by the commercial systems used. Few school systems develop their own handwriting program and if they do, this program is implemented primarily by the purchase of appropriate instructional materials from a number of commercial systems available. Perhaps most serious of all is the meager effort going into the development of better evaluation procedures in this field. Most of the scales, even though revised, are not particularly suitable for instructional purposes.⁷

When comparing the findings of the King survey and of the Herrick and Okada survey, one notes that administrators generally are not aware of the handwriting practices in their own systems. Whereas King reported that 30 per cent of all the school systems have no formal handwriting program, Herrick and Okada found that more than 95 per cent of all the

⁷Virgil E. Herrick and Nora Okada, "The Present Scene: Practices in the Teaching of Handwriting in the United States--1960," New Horizons for Research in Handwriting, the University of Wisconsin Press, Madison, 1963, p. 27.

teachers reporting state they do teach handwriting. This may indicate a need for a revival of the supervisors of handwriting instruction in order to re-open the lines of communication in handwriting instruction between teachers and administrators.⁸

This lack of interest in the importance of handwriting instruction is not restricted to administrators in education. Some teachers fail to realize that their example to the children is important. In Los Angeles a supervisor complained: "It's not unusual to see a teacher drilling her class in writing and a few minutes later doing blackboard work in an unreadable scrawl that is entirely her own."⁹

Handwriting

Handwriting is a complex psychomotor process involving movement, velocity, rhythm, and pressure phenomena.¹⁰ From a clinical point of view, Callewaert believes that good handwriting grows out of the coordination of the "inscriptive movement of the fingers, with the cursive movement of the forearm and the hand."¹¹ The process of handwriting culminates in the writing act to produce legible symbols

⁸Fred M. King, op. cit., pp. 483-486, 493; and Virgil E. Herrick and Nora Okada, op. cit., p. 19.

⁹Anonymous, "A Nation of Scrawlers," Time, February 10, 1947, p. 33.

¹⁰Dan W. Andersen, "Handwriting Research: Movement and Quality," Research in Handwriting and Spelling, Thomas D. Horn, ed., National Council of Teachers of English, Champaign, Illinois, 1966, p. 10.

¹¹H. Callewaert, "For Easy and Legible Handwriting," New Horizons for Research in Handwriting, Virgil E. Herrick, ed., The University of Wisconsin Press, Madison, 1963, p. 39.

which when combined are a medium of communication.

Seifert, Schell and Burns believe that there are individual differences in handwriting and that children develop personalized forms of writing.¹² While agreeing that writing is a means of recording and communicating ideas, Veal states that "an individual must think what he wishes to write."¹³ Coughlin describes handwriting as a conscious and personal act, and Topetzes believes that handwriting is affected by individual differences and that many persons seem to reflect their personal characteristics in their handwriting.¹⁴

The purpose of handwriting appears to be its use as a vehicle to facilitate the communication of ideas. As early as the 1920's, Bailey stated that next to speech, writing is the most important medium of communication.¹⁵ The Alberta program for handwriting instruction describes handwriting as "a skill...a tool used to record and facilitate thinking."¹⁶

¹²Eloise P. Seifert, Personal Styles of Handwriting in Grades Six, Seven, Eight and Nine, (unpublished Ph.D. thesis, Boston University, 1959), p. 9; and Leo M. Schell and Paul C. Burus, "Relation and Changes by College Students of Certain Upper-case Cursive Letter Forms," Elementary English, Vol. XL, pp. 513-517, March, 1960.

¹³Rosa Cordelia Veal, "Writing--One of the Language Arts," Education, Vol. LXXX, March, 1960, p. 408.

¹⁴Lawrence J. Coughlin, "Legal Aspects of Handwriting," Education, Vol. LXXX, March, 1960, p. 405; N. J. Topetzes, "Modern Concepts of Handwriting," Education, Vol. LXXX, March, 1960, p. 389.

¹⁵J. J. Bailey, Teachers' Manual to the Alberta Writing Course, Educational Book Co. Ltd., Toronto, 1928, p. 5.

¹⁶Alberta Government Publication, Interim Elementary Curriculum Guide for Handwriting, Province of Alberta, Department of Education, 1965, p. 5.

Gelb thinks "writing is a system of intercommunication by means of conventional visible marks."¹⁷ Herrick summarizes these thoughts by defining handwriting within the framework of written language when he states,

Handwriting is a tool, a skill which should become routine as rapidly and efficiently as possible in order that it may be used functionally by a person to express and record his thoughts and feelings for himself and others to read.¹⁸

Thus, one may conclude that, as a child effectively develops his handwriting act, he establishes a personal and important medium for both the expression and communication of his ideas and feelings.

Goals of Handwriting

According to Andersen, handwriting always has been and presently is a major preoccupation of civilized man.¹⁹ From antiquity and history we see that handwriting has developed and changed to meet man's needs in early, ancient, and modern civilizations.

As with other things concerning people, fashions in handwriting have changed. In the past the primary goal of handwriting has been perfection in style and form directed toward beauty and aesthetic qualities. Whereas in the early part of this century good handwriting was not only a matter of expression and communication but an end in itself, the

¹⁷Ignace J. Gelb, A Study of Writing, Revised Edition, University of Chicago Press, Chicago, 1963, p. 12.

¹⁸Virgil E. Herrick, "Manuscript and Cursive Writing," Education, Vol. XXVII, 1960-1961, p. 264.

¹⁹Dan W. Andersen, op. cit., p. 9.

present objective in handwriting is not beauty, but legibility. Greene and Petty believe that the principle objective of handwriting is communication: "Children write in order to communicate; in order to communicate, the handwriting must be legible." In terms of mechanical skills, Greene and Petty also believe that good handwriting must make a pleasing appearance, must be easily written, and good handwriting must show vitality in quality of line and spacing.²⁰

The Alberta program of studies for handwriting instruction states that instruction in handwriting is successful to the degree that it develops:

1. legible handwriting;
2. ease of writing;
3. adequate speed;
4. a pleasing appearance;
5. the desire to produce good handwriting as a result of the knowledge of its importance;
6. the ability to diagnose and correct specific faults.²¹

The effective development of legible and fluent handwriting is, then, an important goal of the school.

Research has shown that handwriting varies with the individual. Furthermore, an individual's handwriting may correspond to the writing style of the day. However, from the point of view of a consumer of writing, the quality of an individual's handwriting is determined by its legibility.²² Thus, if good handwriting is to be legible, it

²⁰Harry A. Greene and Walter T. Petty, Developing Language Skills in the Elementary Schools, Allyn and Bacon, Inc., Boston, 1963, pp. 117-118.

²¹Alberta Government Publication, op. cit., p. 5.

²²Virgil E. Herrick, and Adrienne Erlebacher, "Evaluation of Legibility in Handwriting," New Horizons for Research in Handwriting. Virgil E. Herrick, ed., "The University of Wisconsin Press, Madison, 1963, p. 215.

must have correct letter formation, uniform slant, good spacing between letters and words, satisfactory alignment and correct size of letters.²³

Legibility

Among recent research in handwriting, Herrick and Erlebacher defined quality in a handwriting sample as its general legibility or readability.²⁴ In its description of good handwriting, the Alberta program for handwriting instruction states that, "the single most important quality of good handwriting is legibility."²⁵ Andersen reported that Quant believes "that legibility is not a unitary characteristic but is a composite of simple elements."²⁶ The Minneapolis Public School System has defined legibility in terms of readability and also in terms of general appearance.²⁷

According to West, legibility means "any written form--such as a digit, letter, word or passage--standing alone is legible if it can be readily and accurately recognized." In contrast, West also defines illegibility as "a lack of ready recognition of the form as constructed--also a possible uncertainty as to which of two or more forms is being expressed."²⁸ Templin, referring to Good's definition of illegible

²³ Harry A. Greene and Walter T. Petty, op. cit., p. 117.

²⁴ Virgil E. Herrick and Adrienne Erlebacher, op. cit., p. 215.

²⁵ Alberta Government Publication, op. cit., p. 5.

²⁶ Dan W. Andersen, op. cit., p. 16.

²⁷ Minneapolis Public Schools, A Guide to Teaching Handwriting, Minneapolis Public Schools, 1956, p. 91.

²⁸ Paul V. West, Better Handwriting: How to Analyze and

handwriting, says it is handwriting "that cannot be read or that can be read with great difficulty, owing to defects of form or construction."²⁹

MacKay reported that Gray, in a study of illegibilities, found that "letter formation is mostly related to legibility and that spacing is next, followed by uniformity of slant."³⁰

Harris, referring to a study by Pressey and Pressey, stated that "relatively few letters--r, n, e, a, o, s, t,--accounted for more than half of illegibilities."³¹ Newland later confirmed these findings and reported:

- a) there were more forms of illegibilities peculiar to different age groups than there were common to two or more age levels;
- b) the illegibilities of only four letters (a, e, n, and t) contributed 45, 46, and 47 percents to the elementary, high-school, and adult groups, respectively;
- c) six of the 20 different illegibilities in the elementary, high-school and adult group contributed to all the illegibilities recorded; writing "e" like "i" resulted in 15 per cent of all illegibilities;
- d) only four types of difficulties in the formation of letters caused over one half of all the illegibilities;
- e) the gross frequency with which illegibilities occurred tended

Improve Your Penmanship. Barnes and Noble Inc., New York, 1958, p. 9.

²⁹ Elaine Templin, Elementary School Journal, op. cit., p. 4.

³⁰ Marion MacKay, A Study of Handwriting in Grade Four, Grade Five, and Grade Six in Alberta, (unpublished M. Ed. thesis, University of Alberta, 1962), p. 14.

³¹ Theodore L. Harris, "Handwriting," Encyclopedia of Educational Research, 3rd edition, Chester W. Harris, ed., MacMillan Company, New York, 1960, p. 622.

to increase with age.³²

In 1952 Gray conducted a survey of handwriting which confirmed the results of the earlier studies of Pressey and Pressey and of Newland. Gray found that the letter "r" was most difficult and that--r, n, e, a, d and c--caused approximately one half of all illegibilities.³³

Lane and Peltola concluded that handedness does not seem to be a determining factor in legibility when legibility is defined as the ease with which a handwriting specimen can be read.³⁴ From the survey of handwriting styles among adults, Templin concluded that handwriting is still paramount to efficiency in the business and social world.³⁵ This suggests that quality in handwriting is a desirable attribute. However, the terms "quality," "legibility" and "readability" are difficult to define clearly. When quality is not considered from the producer's point of view, and if general appearance is disregarded as an element of legibility, quality can be defined from the point of view of the consumer of handwriting. Herrick and Erlebacher described quality as general legibility or readability.³⁶

³²T. Ernest Newland, "An Analytical Study of the Development of All Illegibilities in Handwriting from the Lower Grades to Adulthood," Journal of Educational Research, Vol. XXVI, No. 4, December, 1932, pp. 249-258

³³Marion MacKay, op. cit., p. 14.

³⁴Patricia A. Lane, and Bette J. Peltola, "A Study of the Handwriting of Left Handed and Right Handed Fourth Grade Writers," (unpublished Colloquium Paper, Faculty of Graduate Studies, University of Minnesota, 1965), p. III.

³⁵Elaine Templin, Comparative Study, op. cit., p. 163.

³⁶Virgil E. Herrick and Adrienne Erlebacher, op. cit., p. 215.

Measurement and Evaluation of Handwriting Quality

According to recent research in handwriting and professional opinion, the most important attribute sought after in good handwriting is legibility. To achieve this many obvious devices and materials have been used by teachers and by school systems. Among these devices and materials one finds more time, specific periods of instruction, planned programs of development and large collections of appropriate materials.³⁷

Although one of the hard facts of handwriting is that its form and capacity to communicate is determined by the nature and structure of the particular language being used, determining the quality--or legibility--of handwriting involves measurement and evaluation of a child's ability to make written symbols.³⁸ Among the materials used to measure and evaluate quality, or legibility, in handwriting are the handwriting scales.

The problem of definition along with the problem of measurement and evaluation has interested many researchers for more than a half century. While Bezzi listed eighteen handwriting scales produced between 1910 and 1946, a recent survey indicated the existence of twenty six commercial systems considered appropriate for handwriting instruction.³⁹ King's survey revealed that fourteen commercial handwriting

³⁷Virgil E. Herrick and Nora Okada, op. cit., p. 32.

³⁸Virgil E. Herrick, "Handwriting and Children's Writing," Elementary English, Vol. XXXVII, No. 4, April, 1960, pp. 248-252, and Diodato Bezzi, Standard Manuscript Scales for Grades I, II and III, (unpublished Ed.D. thesis, University of Oklahoma, 1957), p. 6.

³⁹Diodato Bezzi, op. cit., p. 6; and Noble J. Kendrick, Jr., "Handwriting Programs in Today's Schools," Elementary English, Vol. XL, May, 1963, p. 507.

systems are presently being used in schools.⁴⁰

During the last twenty years, five handwriting scales have been published by Bezzi (1957), Hume (1957), West (1957), Freeman (1959), and Herrick and Erlebacher (1961). However, the Thorndike (1910), Ayres (1915), and Freeman (1915, 1959), handwriting scales, also, are being used in many schools today. The characteristics of these scales are summarized in the chart on page 23.

Thorndike's scale for measuring quality in children's handwriting was the first scientifically constructed handwriting scale in North America. Thorndike's conception of quality was "general merit." Ayres defined handwriting quality functionally as "readability" or "legibility." While the Thorndike scale was designed to measure general appearance as well as legibility, the Ayres scale measured legibility related to speed of writing. Both the Thorndike and Ayres scales provide only one set of handwriting specimens for all grades, thus disregarding the developmental aspects of the writers as well as the individual differences in children's handwriting.

Whereas Thorndike's and Ayres' descriptions of quality in handwriting were all-inclusive in nature, Freeman believed that a handwriting scale should be more analytical.⁴¹ In 1915 Freeman developed his first measure of quality in handwriting consisting of a set of five scales to measure three grades of excellence. Freeman considered general

⁴⁰Fred M. King, op. cit., pp. 483-486, 493.

⁴¹Frank N. Freeman, "A New Handwriting Scale," Elementary School Journal, Vol. LIX, January, 1959, pp. 218-221.

CHARACTERISTICS OF SCALES FOR EVALUATION OF LEGIBILITY IN HANDWRITING^a

Characteristics	Thorndike (1910)	Ayres (1912, 1915)	Freeman (1912)	Freeman (1959)	West (1957)
1. Sex	Both male and female	Both male and female	Both male and female	Both male and female	Both male and female
2. Handedness	Both R and L	Both R and L	Both R and L	Both R and L	Both R and L
3. Grades included	5 - 8	4 - 6	2 - 8	1 - 8, 9	2 - 8
4. Composite or individual grade scale	Composite (cursive)	Composite (cursive)	Charts cover grades 2 - 8 (cursive)	Grades 2, 3, and 4; 5 and 6; 7 and 8 (cursive)	Individual grade scales on one sheet (cursive)
5. Reliability	P. E. of individual placement, 1.4 to .45	Not given	Not given	Not given	Not given
6. Speed	Usual	Usual	Usual for writing well	Usual for writing well	Usual but with quality
7. Norms for speed	None	None	2-minute sample, number of words per minute	2-minute sample number of words per minute	Scaled for speed and quality. 2-minute sample
8. Material copied or memorized	Copybook needed	Memorized and copy available	Memorized	Memorized	Memorized and copy available

CHARACTERISTICS OF SCALES FOR EVALUATION OF LEGIBILITY IN HANDWRITING^a (Continued)

Characteristics	Thorndike (1910)	Ayres (1912, 1915)	Freeman (1912)	Freeman (1959)	West (1957)
9. Nature of material	A single determined sample: "Then the carelessly dressed gentleman stepped lightly..."	A single sample: "Four score and seven years ago ..."	"The quick brown fox jumps over the lazy dog."	Different specimens for each grade level. Material judged appropriate for grade level	Different specimens for each grade, familiar words, materials appropriate for level
10. Criterion of placement	Median placement by 30-40 judges	Each sample read by 10 judges (median words per minute is score for each sample)	Judges determine samples in three levels of excellence	Median placement by judges	Quality and speed
11. Characteristics considered	General merit	Readability-- samples of vertical, medium and extreme slant	Excellence in uniformity of slant, uniformity of alignment of letters, and spacing between letters and words	Legibility, form, ease, and fluency	Quality and speed

CHARACTERISTICS OF SCALES FOR EVALUATION OF LEGIBILITY IN HANDWRITING^a (Continued)

Characteristics	Thorndike (1910)	Ayres (1912, 1915)	Freeman (1912)	Freeman (1959)	West (1957)
12. Number of quality levels considered	17 levels of judged equal steps. One artificially produced very bad sample rated at 4. Two 4th grade samples rate as 5, 6. One copy book sample rated at 18 (best)	8 scale points obtained by assuming normal distribution. Base line from 0 to 100, median at 50 (20, 30, 40, 50, 60, 70, 80, 90)	5 separate charts with 3 grades of excellence. No cross grade comparisons. Summation of ratings for each of specific qualities used for 1st rating. Equal weight for all qualities but letter formation which is doubled	Each grade scale has five levels of quality	7 scales, one for each grade with seven levels of quality--poorest sample with slowest speed to best sample of fastest speed
13. Nature of scale	Cardinal	Cardinal	Ordinal	Ordinal	Ordinal
14. Size of sample	1000 samples, 30-40 judges	1578 samples, 10 judges. 15780 readings, 10 for each sample	Not given	135, 491 samples from 162 cities, 43 states: 10, 646 to 22, 374 samples at each grade	Represented all parts of U. S. 644+ samples at each grade level, 42, 000 judgements

^aVirgil E. Herrick and Adrienne Erlebacher, "Evaluation of Legibility in Handwriting," New Horizons for Research in Handwriting. Virgil E. Herrick, ed., The University of Wisconsin Press, Madison, 1963, pp. 210-211.

excellence as a sum of five specific factors: letter formation, uniformity of slant, uniformity of alignment of letters, quality of line, and spacing between letters and words.⁴²

Freeman's Analytical Scale for Judging Handwriting, 1915, was revised in 1959 when he proposed a "new scale." The new scale stipulated general excellence as the criterion of quality; it did not consider the evaluation of specific factors. In its final form, Freeman's "new scale" consists of five specimens of handwriting for each grade representing the best, the poorest, the middle, those between the best and the middle, those between the poorest and the middle.⁴³

West's American Handwriting Scale was developed in 1956-1957. Along with speed, West included "quality-legibility" as a characteristic of his scale for evaluation of legibility in handwriting.⁴⁴ Although The American Handwriting Scale does not identify different aspects of handwriting quality, it makes it possible for pupils, teachers and administrators to measure the rate and quality of cursive writing in grades II through VIII, and provides a group of seven scales, one for each grade, adaptable to any local marking system.⁴⁵

In 1957 Bezzi developed a five-step quality scale for

⁴²Frank N. Freeman, The Teaching of Handwriting, Houghton-Mifflin Company, New York, 1914-1915, p. 119.

⁴³Frank N. Freeman, op. cit., p. 218.

⁴⁴Dan W. Andersen, op. cit., p. 14.

⁴⁵Virgil E. Herrick, and Adrienne Erlebacher, op. cit., p. 213.

may be improved by: (a) averaging the scores from several independent testing sessions; and (b) providing additional training materials for teachers.⁴⁸

From her study of subjectivity of elementary school teachers in grading handwriting, Rondinella concluded that many teachers are insufficiently aware of the major criteria for grading writing specimens.⁴⁹ From Feldt's suggestions for improving the reliability of teachers' use of scales and from Rondinella's conclusion, it appears that teachers may require in-service training in the use of handwriting scales to rate quality in children's handwriting.

Research Related to the Study

While much of the professional literature on handwriting expresses opinions about children's handwriting, there are several pieces of research related to teachers' rating of quality in legibility in handwriting. It is the purpose of this section to discuss research into the aspects of quality which influence teachers' ratings of legibility in children's handwriting.

In 1940 Freeman said that statements are sometimes made as to the elements on which a handwriting scale is based, such as legibility, beauty, and character in the Thorndike scale, and legibility

⁴⁸Leonard S. Feldt, "The Reliability of Measures of Handwriting Quality," Journal of Educational Psychology, Vol. LIII, No. 6, 1962, pp. 288-292.

⁴⁹Oreste Rondinella, "An Evaluation of Subjectivity of Elementary School Teachers in Grading Handwriting," Elementary English, Vol. XL, May, 1963, pp. 531-532.

in the Ayres scale. He also stated that there is no evidence as to what elements actually determine the judgements of persons who use the scales.⁵⁰

In 1946 Quant, in a study of readability, attempted to single out various factors that might account for legibility. He systematically varied the factors of letter formation, uniformity of slant, uniformity of alignment of letters, quality of line, and spacing between letters and words. It was these factors that Freeman considered were aspects of quality which he used as criteria in his Analytical Scale for Judging Handwriting (1915).⁵¹

Templin conducted a survey of handwriting styles among adults in 1958. The respondents in this study were 1,946 graduates of high schools in twenty communities located in six east coast states of the United States. Twenty-three per cent of the located population replied. Homemakers, business workers, educators and engineers accounted for nearly 65 per cent of the total response. Fifteen per cent were excluded because they were left handed, had changed the hand with which they wrote or had suffered a crippling disease or disabling injury. From an examination of her findings dealing with the most commonly used writing tools today, the most common uses of handwriting, and the amount of handwriting adults produce, Templin

⁵⁰ Frank N. Freeman, "Handwriting," Encyclopedia of Educational Research, Walter S. Monroe, ed., MacMillan Co., New York, 1941, pp. 555-561.

⁵¹ Frank N. Freeman, op. cit., The Teaching of Handwriting, p. 119; and Leslie Quant, "Handwriting," Encyclopedia of Educational Research, Chester W. Harris, ed., The MacMillan Co., New York, 1961, p. 621.

concluded that "handwriting legibility is still paramount to efficiency in the business and the social world."⁵²

The Director of Instruction for the Public Schools of Rochester, Minnesota, Fred M. King, reported a survey he had conducted covering 680 superintendents of towns above 2,000 population in four mid-western states. King's purpose for conducting the survey was to "ascertain the degree to which handwriting is being emphasized in our schools today," and "to determine the extent to which school administrators are concerned with handwriting programs today."⁵³

King's survey deals indirectly with teachers' rating of legibility in children's handwriting. He reported that thirty per cent of all the school systems surveyed neither use one of the established commercial programs nor have they organized a formal program of their own. Whereas fourteen commercial handwriting systems are presently being used in the four states, ninety eight per cent of the cities that have formal programs use the handwriting material of two companies. While fifty nine per cent of those reporting felt a minimum of fifty minutes per week should be devoted to organized formal handwriting lessons, thirty per cent designated no time at all is being given to formal handwriting instruction. Only nine per cent of those reporting require some elementary teachers to have had a course in

⁵²Elaine Templin, op. cit., Comparative Study, p. 2; and Elaine Templin, op. cit., Elementary School Journal, p. 163.

⁵³Fred M. King, op. cit., Elementary English, pp. 483-486, 493.

handwriting instruction. King's report suggests a lack of interest on the part of administrators in handwriting instruction. However, Fieman pointed out a need for supervising teachers to develop more positive attitudes towards handwriting and the need of the groups studied to improve their own handwriting.⁵⁴ King's and Fieman's studies bring into focus not only the present emphasis on handwriting instruction, the administrators' interest in handwriting instruction, and supervisors' attitudes toward handwriting, but also the current educational leadership in handwriting instruction. The lack of educational leadership in handwriting instruction may have some effect on teachers' rating of legibility in handwriting, as well as on handwriting instruction in the schools.

Prior to 1962 no comprehensive national survey of handwriting instruction was available. By means of questionnaire, Herrick and Okada (1960) investigated the general nature of the instructional program in handwriting, factors emphasized and teaching techniques used, handwriting systems and materials, and writing instruments and surfaces. For the national survey, six hundred county and independent urban school systems were randomly selected. The systems were categorized according to size, and 16,751 questionnaires were sent to individual principals and teachers. A similar plan was used in the Wisconsin Survey (1951). Similarities were found in the two surveys.

⁵⁴Marvin Eugene Fieman, "The Construction of a Scale for Measuring Attitudes of Prospective and Supervising Elementary School Teachers Towards Handwriting," (unpublished Ed. D. thesis, University of California, Los Angeles, 1963), Dissertation Abstract, Vol. XXIV, 1087.

From their numerous findings, Herrick and Okada noted that teachers place in the following order these aspects of handwriting quality: correctness of letter formation, neatness of writing, uniformity of letters, spacing of letters and words, size of letters, alignment of words and sentence, and speed. Speed of writing is not emphasized until the middle and upper grades and, of all the factors, speed is considered least important.⁵⁵

In their study, *The Evaluation of Legibility in Handwriting*, Herrick and Erlebacher wanted to produce a scale with the following characteristics:

1. the power to discriminate in legibility among several handwriting samples written by the same person under different conditions of writing;
2. the power to quantify differences in legibility in terms of a cardinal number system;
3. the power to match any given sample of handwriting for the writing characteristics of slant and size of letters;
4. the power to cover the total range of legibility found in the writing of middle-grade children.⁵⁶

While Herrick and Erlebacher's scale was mainly limited to cursive handwriting for right handed writers, Lane and Peltola (1965) using similar scaling procedures investigated the legibility of handwriting of left handed and right handed fourth grade writers. Lane and Peltola found the most highly rated samples tended to have letters which were of large size and well formed. They concluded that size

⁵⁵Virgil E. Herrick and Nora Okada, *op. cit.*, pp. 17-21.

⁵⁶Virgil E. Herrick and Adrienne Erlebacher, *op. cit.*, pp. 207-236.

and letter formation influence legibility of fourth grade handwriting. Lane and Peltola also found that slant in legible handwriting does not seem to vary according to any well defined pattern for children at the end of the fourth grade.⁵⁷

Rondinella, in 1963, investigated the subjectivity of elementary school teachers in grading handwriting. Two hundred and ten elementary school teachers rated 239 fourth-, fifth-, and sixth-grade children. Rondinella concluded that teachers are subjective in their rating of children's handwriting, and also that many teachers are unaware of the major criteria for grading handwriting. The 210 judges mentioned fourteen different characteristics of writing. This is a significant contrast to the five aspects of quality mentioned by Freeman or to the "general merit" and "readability" suggested by Thorndike and Ayres. A further examination of Rondinella's conclusions indicates that teachers are influenced by letter formation, neatness, and writing which can be easily read; stroke, general quality, and speed were considered least important.⁵⁸

Rondinella would agree with Feldt that the reliability of teachers' judgements when using handwriting scales is low. Rondinella would also agree that many teachers are unaware of the aspects of quality used as criteria in handwriting scales.⁵⁹

⁵⁷Patricia A. Lane and Bette J. Peltola, op. cit., p. 112.

⁵⁸Oreste Rondinella, op. cit., pp. 531-532.

⁵⁹Leonard S. Feldt, op. cit., pp. 268-272.

Summary

Handwriting is widely thought of not only as an instrument for communication, but also as a vehicle of individualized personal expression. While using his measurable ability to make written symbols and developing his handwriting, a child establishes an important medium for communication.

According to research, legibility is presently considered the chief goal in handwriting instruction. Investigators in handwriting research have for more than fifty years attempted to define quality and have also devised handwriting scales for measuring quality. From the characteristics of handwriting that have been used as criteria of quality in handwriting scales, and also from professional opinion and research, the qualities of letter formation, spacing and uniformity of slant have all been identified as factors in determining legibility in handwriting.

The terms "quality," "legibility," and "readability" are difficult to define for each term seems to possess aspects of the other two. However, this problem of definition is solved when quality is considered, not from the producer's point of view but from the point of view of the consumer of handwriting. Thus, Herrick and Erlebacher disregarded the general appearance of handwriting and described quality as general legibility or readability.⁶⁰

The studies conducted by Herrick and Okada and by Rondinella conclude that teachers rate the general factor of legibility as

⁶⁰Virgil E. Herrick and Adrienne Erlebacher, op. cit., p. 216.

the most important objective in handwriting. It is also reported that current teaching techniques presently tend to emphasize legibility factors in the following order:

1. correctness of letter formation;
2. neatness of writing;
3. uniformity of letters;
4. spacing of letters and words;
5. size of letters;
6. alignment of words and sentences;
7. speed of writing.⁶¹

The review of the related handwriting literature has shown that the process of handwriting culminates in the handwriting act to produce legible symbols which when combined are a medium for communication. The purpose of handwriting is its use as a vehicle to facilitate communication; therefore the major goal of handwriting is to help the child produce legible and fluent handwriting. A child's ability to produce legible handwriting is among his measurable skills.

Although many devices have been developed to measure and evaluate children's handwriting, the process used by teachers to rate handwriting has not been clearly defined. When legibility is considered the single most important quality in handwriting, there is an uncertainty as to what elements of legibility influence teachers' judgements most.

⁶¹Virgil E. Herrick and Nora Okada, op. cit., p. 21.

CHAPTER III

THE PLAN OF RESEARCH

Introduction

Letter formation, spacing, and slant have been identified frequently as factors of legibility in handwriting. However, it is not certain which elements of legibility have the greatest influence on teachers' judgments of children's handwriting. There is also a question whether the terms "general appearance" and "legibility" represent the same qualities in handwriting. Whether teachers rate children's handwriting the way the Interim Elementary Curriculum Guide for Handwriting in Alberta suggests they do can also be questioned.¹ This chapter describes the plan of research used to investigate these questions.

From the point of view of the consumer of handwriting, it can be assumed that legibility is quality in handwriting. The selection of four aspects of quality in handwriting and a criterion for comparison, the collection of the samples, the selection of the specimens to be rated, the judgments, the hypotheses to be tested, the method of statistical analysis and the data are described in this chapter.

The criteria. For the purposes of this study, four aspects of quality in handwriting and a criterion with which to compare them were selected. Professional opinion and previous research have

¹ Alberta Government Publication, Interim Elementary Curriculum Guide for Handwriting. Province of Alberta, Department of Education, 1965, p. 5.

identified letter formation, spacing, and slant as elements contributing to legibility and that legibility is the single most important quality in handwriting. Therefore these factors were selected for this study and were compared with a criterion variable, here called "general appearance." General appearance represented the way teachers usually rate children's handwriting. Thus, general appearance ratings were investigated and compared with teachers' ratings based on letter formation, slant, spacing, and legibility as separate criteria.

The handwriting samples. In order to carry out the purposes of this study, handwriting samples were selected from a population of 262 grade five subjects in three schools of the Edmonton Public School System. Since the study was investigating the way teachers usually rate children's handwriting, it was preferable to select a narrow population on the basis of socio-economic status and attempt to eliminate variation on concomitant factors which may influence handwriting. It was considered adequate for obtaining these judgements that the total range of handwriting quality of a given population be represented.²

The subjects were requested to write a given sentence four times in their usual handwriting according to specified directions. They were to use the ball point pen supplied by the Edmonton Public School Board and the type of foolscap usually used in schools. In this effort to retain a natural situation, the object was to get a set of typical specimens which would be truly representative of grade five

²Fred N. Kerlinger, Foundations of Behavioral Research, Holt Rinehart and Winston Inc., New York, 1965, pp. 96, 583.

handwriting.

From this collection of handwriting samples, ninety were randomly identified with the aid of a table of random numbers. The third sentence of each randomly selected sample of handwriting was selected as representative of the usual way in which children write. The third sentence, hereafter referred to as "the handwriting specimen," was selected because it was felt that at this point in his writing the subject would be relaxed, would have gained sufficient knowledge of the writing task, and would be interested in the sentence. The first and second sentences were not selected because it was thought the subjects were not familiar enough with the substance of the task. The fourth sentence was not selected because the students may have lost interest in the writing task.

The writing task. The text selected for the writing task in the study was, "The quick brown fox jumps over the lazy dog."³ Freeman used this text in 1915 when he created his first handwriting scale. Herrick and Erlebacher in their study of legibility used this text in 1961 because it was short enough to remember easily, contained all the letters of the alphabet, contained words that are easily spelled, had meaning for children and adults and could be easily compared with other specimens of handwriting.⁴

³Harry A. Green, Albert H. Jorgensen, J. Raymond Gerberich, The Measurement and Evaluation in Elementary School, Longmans, Green and Co., New York, 1953, pp. 451.452.

⁴Virgil E. Herrick, New Horizons for Research in Handwriting, The University of Wisconsin Press, Madison, 1963, p. 216.

Greene et al, believed that the nature of the material which students are requested to write under test conditions may influence the sample of handwriting produced. Because a handwriting task should contain familiar, simple and easily understood material as well as being the same for all students, the text selected for the study was considered appropriate for the handwriting population.⁵

The writing materials. In order to obtain a sample of grade five children's usual handwriting the writing task was written on blue-lined, pink-margined foolscap with a ball point pen. The foolscap was the same as that supplied to the schools by the Edmonton Public School System. The ball point pen was supplied by the school system. By using the materials to which the children were accustomed, it was thought the subjects would be more inclined to write in their usual way.

The ball point pen was selected as the writing instrument because it was readily available to all the subjects, and because it is one of the commonly used writing tools.⁶ Furthermore, if all the handwriting samples were produced with the same instrument, a teacher's preference for a particular writing tool would not necessarily prejudice his judgment of the handwriting specimens.

The writing surface and the writing instrument permitted

⁵Harry A. Greene et al, op. cit., p. 451.

⁶Elaine Templin, A Comparative Study of Legibility of Handwriting Styles : All Cursive, All Manuscript or Manuscript-Cursive, Ph. D. Thesis, New York University, 1958, p. 2.

a clear, sharp writing line with no ink blots or smudges that might prejudice the teachers' judging the handwriting specimens. However, the teachers collecting the handwriting samples were instructed to forward to the investigator all samples, regardless of spelling errors, erasures, or any other writing problem.

Rating The Specimens

The judges. To obtain an adequate number of judgements, it was decided that thirty competent judges were needed to assess the ninety handwriting specimens. Since it was important that a typical population of teacher judgements be obtained, it was decided to invite thirty practising teachers in grades four, five, and six to rate the handwriting specimens separately for each of the criteria.

The judging. The instructions for judging the specimens had the following rationale.

- a. The handwriting specimens would be judged for general appearance, spacing, letter formation, slant and legibility, in that order. Research has indicated that letter formation is a dominant criteria used by teachers when rating children's handwriting. Therefore, letter formation was placed as far as possible from general appearance, the way teachers usually rate children's handwriting, and legibility, or quality in handwriting, in the order of judging to avoid any bias that might be transferred from one judging session to another. The order of judging was consistent for all judges for all

criteria.

- b. The instructions for rating the specimens were administered orally by the investigator to each judge before each judgement session took place. This was done to orient the judges to the particular criterion and to eliminate, as far as possible, any misunderstanding of the task so that such judgement session would be standard.
- c. Each judge rated each specimen separately for each of the five criteria selected for the study. The ratings, averaged over all the judges for each specimen and for each criterion, provided the raw data for this study.
- d. The judging took place during five different sessions to avoid any bias that might come from the interference of the previous criterion in a new judgement session.
- e. The judges rated the handwriting specimens by placing them on a continuum of handwriting quality.

The continuum of handwriting quality. The continuum of handwriting quality was based on Q-technique which is mainly a form of rank ordering objects and then assigning numerals to subsets of the object for statistical analysis.⁷ For this study the Q-technique involved the sorting of the deck of ninety specimen cards to determine a value for each specimen for each criterion by each judge.

⁷Fred N. Kerlinger, Foundations of Behavioral Research, Holt Rinehart and Winston Inc., New York, 1965, p. 581.

In the continuum of handwriting quality, the numbers 3, 4, 7,, 7, 4, 3 are the numbers of handwriting specimens to be placed in each category. The numbers above the line are the numbers assigned to the categories representing a continuum of handwriting quality ranging from the poorest to the best. By placing the specimens on the continuum each judge arrived at a value for each specimen and for each criterion according to his professional opinion. The means of these values provided five average ratings for each specimen. The average ratings were subjected to statistical analyses.

	Poorest-----Best										
Category	1	2	3	4	5	6	7	8	9	10	11
No. of specimens	3	4	7	10	13	16	13	10	7	4	3

Controls. Several factors were controlled in the judgement of the handwriting specimens.

- a. It was necessary to create a mental set appropriate to a particular criterion. As in Herrick and Erlebacher's study, Evaluation of Legibility in Handwriting, the warm-up materials were used to orient a judge to the criterion to be implemented during a judging session.⁸
- b. For statistical stability it was decided that the deck of specimen cards should consist of ninety randomly selected handwriting specimens.⁹ The sorting of ninety

⁸Virgil E. Herrick and Adrienne Erlebacher, op. cit., p. 222.

⁹Op. cit., Kerlinger, pp. 581-583.

specimen cards was a large number for each judge to rate five times. However, it was necessary to have a number as large as ninety specimen cards because a large number of judgments were needed for statistical purposes.

- c. The order of presentation of items to judges tends to influence the ratings given. To reduce the order effect on the rating of any one specimen, it was necessary to present the specimens in different orders to different judges. Since complete randomization or counterbalancing seemed impractical, varied patterns of presentation to judges within each criterion were built into the design of the study. This made possible re-ordering of the specimens over the judges and across five criteria.¹⁰
- d. The judges rated the specimens according to general appearance, spacing, letter formation, slant, and legibility in that order. Related literature has revealed that teachers consider letter formation of great importance when rating children's handwriting.¹¹ The judges rated the specimens in the given order with

¹⁰B. J. Winer, Statistical Principles in Experimental Design, McGraw Hill Book Company Inc., New York, 1962, pp. 514, 521, 523.

¹¹Oreste Rondinella, "An Evaluation of Subjectivity of Elementary Teachers in Grading Handwriting," Elementary English, Vol. XL, May, 1963, pp. 531-532.

letter formation as far as possible in order and time from either general appearance and legibility. The order was standard for all judges.

The Questions, Hypotheses and Method of Analysis

The questions. The thesis for this study was derived from related research. Four questions form the basis for this investigation.

- a. Is there a significant relationship among the elements of legibility in handwriting?
- b. What elements of legibility, either singly or in combination, predict the way teachers usually rate children's handwriting?
- c. Do the terms "general appearance" and "legibility" represent the same qualities in handwriting?
- d. Do teachers rate children's handwriting using the criterion suggested in the Alberta Interim Elementary Curriculum Guide?¹²

The hypotheses. To investigate the questions, seven major hypotheses were formulated. Each hypothesis was intended to test a relationship among the five criteria of quality in handwriting selected for this study. The hypotheses were in the null form and were tested statistically by submitting the means of the teachers' judgements to multiple linear regression analysis. Thus it was hypothesized that:

1. The factors of letter formation, spacing, slant and

¹²Alberta Government Publication, op. cit., p. 5.

legibility, taken one at a time, are not significant predictors of general appearance.

2. When scores on general appearance are adjusted for each variable in turn for each other variable, none of the factors of letter formation, spacing, slant, and legibility is a significant predictor of general appearance.
3. When scores on general appearance are adjusted for all possible pairs of factors for each variable, none of the factors of letter formation, spacing, slant, and legibility is a significant predictor of general appearance.
4. When scores on general appearance are adjusted for the three other effects, none of the variables of letter formation, spacing, slant and legibility is a significant predictor of general appearance.
5. The factors of letter formation, spacing, and slant taken one at a time, are not significant predictors of legibility.
6. When scores on legibility are adjusted for each variable in turn for each other variable, none of the factors of letter formation, spacing and slant is a significant predictor of legibility.
7. When scores on legibility are adjusted for all possible pairs of factors for each variable, none of the factors of letter formation, spacing and slant is a significant predictor of legibility.

The method of analysis. The interrelationship among the average ratings for each criterion was investigated. Correlation coefficients

were calculated to measure these relationships of each independent variable to the criterion variable. Where there was a significant measure of relationship, the data were subjected to multilinear regression analysis. The multilinear regression analysis investigated the relationships between a set of independent variables, or criterion.¹³ To accommodate this analysis, the Reg-200 program for the 7040 I. B. M. computer at the Computing Centre, University of Alberta, was modified and used in this study.

Collection of the Data

The pilot study. The purpose of the pilot study was to refine the methods and materials to be used in the study. According to specified directions, each of the ninety one subjects from grade five in a pilot study school contributed a sample of his handwriting for the initial investigation. From the collection of samples, twenty specimens were randomly selected for the study. One elementary school teacher, an elementary school principal, and five graduate students from the Department of Elementary Education, University of Alberta, judged the twenty specimens following the administration of the oral instructions by the investigator. The methods and materials tested in the pilot study proved satisfactory and they were used in the study. These methods and materials are described fully in the following sections of this chapter.

¹³ Division of Educational Research and the Department of Elementary Education, Modified Guide for Preparation of Data for Linear Regression Analysis on Reg-200, University of Alberta, October, 1966, pp. 1-7.

The Handwriting Specimens

Identification of the population. Assistance was requested from Mr. T. D. Baker, Associate Superintendent, Edmonton Public School Board, Edmonton, Alberta, and permission to conduct handwriting research in three schools was granted (Appendix A). Thus each of 262 grade five students living in a middle class residential area contributed a sample of his handwriting for research purposes in the study.

Collection of the handwriting samples. In order to carry out the purposes of the study handwriting samples were collected from 262 grade five students in three schools. The subjects were requested to write four times, according to specified directions, a sample of their usual handwriting.

Except for the writing instrument, a ball point pen supplied by the School Board, all materials necessary for collecting the handwriting samples were supplied by the investigator. A covering letter was sent to each principal and each teacher, along with a kit containing a pad of foolscap, instructions for collecting the handwriting samples, and a check list (Appendix A). To facilitate the collection of handwriting samples, the investigator through prior arrangement with each principal had obtained the names of the subjects in each grade five classroom. The subjects' names were typed on the check lists enclosed with each kit.

The teachers were asked to collect the handwriting samples from their pupils during a regular handwriting period. This would tend

to provide normal handwriting conditions. Under these circumstances the samples of handwriting produced would be the children's usual handwriting. The teachers were also asked to indicate the sex and handedness of their pupils and to make any pertinent comments on the prepared check list enclosed in the handwriting kit.

The writing task selected for this study was considered standard for all the subjects and short enough to remember easily. To avoid any bias that might come from teachers' models, from memorization or from preliminary practice, the directions for collecting the handwriting samples included the following instructions.

1. At no time should the writing task be printed or written on the board.
2. (a) Read and discuss the sentence to be written, with the class.
(b) Repeat the sentence until the child knows it.
(c) Do not dictate the sentence as the children write.

Thus, when the handwriting specimens for this study were randomly selected from this collection of handwriting samples, the judges were rating the typical handwriting of grade five pupils.

Selection of the handwriting specimens. Two hundred sixty two samples of handwriting were collected from the handwriting population. Five samples were discarded because the subjects had not put their names on the foolscap, making identification impossible. The handwriting specimens to be studied were selected from the remaining 257 handwriting samples. For statistical stability in the Q-sort, and in order to obtain an adequate number of judgements, ninety handwriting

samples were randomly selected from which every third specimen was cut and included in the deck of ninety specimen cards.

Table I describes the ninety subjects whose samples of handwriting were selected for study. The subjects seem representative of the general population of grade five pupils on the characteristics of sex and handedness.

TABLE I
SUMMARY OF THE CHARACTERISTICS OF NINETY
SUBJECTS SELECTED FOR STUDY

	Sex		Handedness		
	Male	Female	Left	Right	Both
Number	41	49	10	80	0
Per cent of total	49. 11	50. 89	11. 11	88. 89	0. 00

All the randomly selected handwriting samples were used in the study. Once the samples were selected, none were discarded. The sentence selected from the sample written by each subject was mounted on a specimen card. Each specimen card was numbered in the upper right hand corner for identification purposes using numbers from 1 to 90. Table II summarizes the random selection and identification of the handwriting specimens (Appendix D).

Rating The Handwriting Specimens

Selection of the judges. To obtain an adequate number of judgements it was decided that thirty competent judges would rate

TABLE II
RANDOM SELECTION AND IDENTIFICATION OF
THE HANDWRITING SPECIMENS

Specimen Card No.	Subject No.	Specimen Card No.	Subject No.	Specimen Card No.	Subject No.
1	54	31	227	61	52
2	26	32	116	62	14
3	238	33	88	63	44
4	181	34	243	64	83
5	175	35	17	65	237
6	93	36	77	66	194
7	148	37	91	67	82
8	95	38	98	68	75
9	55	39	218	69	66
10	69	40	70	70	40
11	73	41	107	71	127
12	38	42	76	72	176
13	86	43	74	73	162
14	84	44	99	74	240
15	31	45	178	75	32
16	78	46	45	76	16
17	63	47	42	77	25
18	3	48	92	78	41
19	215	49	48	79	33
20	81	50	19	80	59
21	199	51	190	81	206
22	61	52	252	82	11
23	62	53	131	83	68
24	56	54	87	84	5
25	50	55	96	85	182
26	7	56	80	86	71
27	28	57	90	87	43
28	157	58	60	88	201
29	13	59	9	89	113
30	30	60	117	90	47

the ninety handwriting specimens for general appearance, spacing, letter formation, slant, and legibility, in that order, and during five different sessions. Thus, thirty grades four, five, and six teachers from the Edmonton Public School System were invited to act as judges. Table III summarizes the characteristics of the judges who seem to be a group representative of the general population according to sex and handedness. The investigator collected this information from the judges during the judging sessions and using the Judges' Personal Data form (Appendix A). Table III also shows that the judges were a competent, practising and professional group of teachers licensed to teach in Alberta schools.

Directions to the judges. It was necessary that the directions to all the judges be standard. Thus, the investigator administered the following directions to all judges. The investigator made certain that the appropriate sub-section of Part B, section 2, was used for each judge during a judgment session. No further assistance or clarification of the sorting procedure or description of any one criterion were given to any of the judges.

The oral instructions to the judges. Part A.

1. I need your assistance in rating handwriting specimens for a study I am conducting.
2. Here are the handwriting specimens and a continuum of handwriting quality. Place the handwriting specimens in piles according to their quality. (See description of continuum.)^a

^aChapter III, page 42.

TABLE III
SUMMARY OF CHARACTERISTICS OF THE
GROUP OF THIRTY JUDGES

A. COMPOSITION OF THE GROUP			
1. Sex	Number	2. Handedness	Number
Male	13	Left	2
Female	17	Right	27
		Both	1
B. QUALIFICATIONS			
1. Grades Presently Teaching	Number		
4	8		
5	8		
5 and 6	1		
6	13		
2. Years of Teaching Experience	Number		
1	4		
2	0		
3	1		
4	2		
5 - 9	5		
10 - 15	8		
16 - 20	3		
More than 20	6		

TABLE III (Continued)

B. QUALIFICATIONS	
3. Type of Certification	Number
Letter of authority	1
Standard E. , Interim	1
Standard E	7
Standard S. , Interim	0
Standard S.	1
Standard E. and S.	1
Professional Certificate, Interim	1
Professional Certificate	4
Professional Certificate, Interim, and B. Ed degree	8
Professional Certificate, and B. Ed degree	1
Professional Certificate, and B. Ed and B.A. degrees	2
Professional Certificate, B. Ed degree, and Administration Diploma	2
Professional Certificate and M. Ed degree	1

3. a. The continuum has spaces for eleven degrees of quality among the handwriting specimens you will judge.
- b. The numbers 3, 4, 7,... 7, 4, 3, are the number of handwriting specimens to be placed in each category. Please note that only the stated number of handwriting specimens are to be placed in each category.
- c. The numbers above the line are the numbers assigned to the categories representing a continuum

of quality. For example:

- i. The three specimens that are placed on your extreme left represent the poorest quality of handwriting and are assigned category one.
 - ii. The sixteen specimens that are placed in the center represent the middle range of the continuum and each specimen is assigned category six.
 - iii. The three specimens that are on your extreme right represent the best quality of handwriting and are assigned category eleven.
4. Your first judgement is adequate. It is not necessary to re-sort should you change your mind.
5. If you wish to facilitate the sorting task you may do the following:
 - a. First sort the specimens into three piles representing the ends and the middle of the continuum. Put as many as you wish in each pile.
 - b. Then re-sort the three piles into six piles representing a continuum of quality from the poorest to the best.
 - c. Finally re-sort the six piles into eleven piles placing the handwriting specimens into their proper places according to the numbers shown in the continuum.

Part B.1. The warm-up exercise:

Before you begin, here is a warm-up exercise to help you become familiar with the procedure.

2. Judging the handwriting specimens:

a. The first judgement--general appearance:

The first judgement concerns the general appearance of the handwriting specimens.

Consider general appearance as the way in which you usually rate children's handwriting in your classroom. Using your judgement of general appearance in handwriting, put the poorest specimens on your left and the best specimens on your right. Place the specimens on this continuum of handwriting quality according to general appearance.

b. The second judgement--spacing:

Here we will judge the handwriting specimens for spacing. Consider the space between the letters and between the words in the handwriting specimens. Then, using your judgement of spacing, put the poorest specimens on your left and the best specimens on your right. Place the specimens on this continuum of handwriting quality according to spacing.

c. The third judgement--letter formation:

This time judge the handwriting specimens for letter formation. Consider the size, shape, and stroke of the letters. The specimens having the poorest letter formation should be placed on your left and the specimens having the best letter formation should be placed on your right. Place the specimens on this continuum of quality in letter formation.

d. The fourth judgement--slant:

For this judgement of quality of handwriting, look at the slant of the letters in the handwriting specimens. Judge the specimens for their quality of slant by putting the specimens having the poorest slant on your left and the specimens having the best slant on your right. Place the specimens on this continuum of quality in slant.

e. The fifth judgement--legibility:

The fifth and last judgement of handwriting specimens will rate the specimens according to their legibility. Consider legibility as the ease with which you can read a sentence. Put the specimens having the poorest quality of legibility on your left, and the specimens having the best quality on your right. Using your judgement of legibility, place the specimens on the continuum of handwriting legibility.

The Continuum of Handwriting Quality

The underlying principles and a description of the Continuum of Handwriting Quality were discussed earlier. The judges made five sorts using the Q-technique.¹⁴ After being properly prepared, each judge made a general appearance sort, a letter formation sort, a slant sort, a spacing sort, and a legibility sort. During each sort each judge assigned a value to each of the ninety handwriting specimens by placing each specimen in one of the eleven categories of handwriting quality according to his own opinion of its adequacy on the criterion being considered. The values of ratings were recorded on a data grid by the investigator for later transcription to a data sheet and IBM data cards (Appendix A).

Preparation of the Judges

Ten handwriting specimens were randomly selected from the collection of handwriting samples in the pilot study to serve as a warm-up exercise. The purpose of the warm-up exercise was to familiarize the judges with a particular criterion prior to each assessment. The warm-up exercise created a mental set appropriate to each judgement session.

The Judgement Session

All the judges rated general appearance first. Then all the judges rated spacing, and so on for letter formation, slant and legibility. A Latin Square of random patterns was devised to ensure that each judge

¹⁴Fred N. Kerlinger, op. cit., p. 583.

saw five separate patterns and that only six judges saw any one pattern for each criterion. Table IV shows the Latin Square design of the order of presentation of specimens to the judges.

TABLE IV
LATIN SQUARE DESIGN FOR PRESENTATION OF
SPECIMEN PATTERNS TO THE JUDGES

Criterion					
Judge Number	General Appearance	Spacing	Letter Formation	Slant	Legibility
1 - 6	1 ^a	5	4	3	2
7 - 12	2	1	5	4	3
13 - 18	3	2	1	5	4
19 - 24	4	3	2	1	5
25 - 30	5	4	3	2	1

^aPattern Numbers

The ninety specimen cards were randomly ordered five separate times. The five patterns were then arranged so that each judge saw the specimens in a different order for each judgement. Table V (Patterns Nos. 1-5), gives the random patterns of the specimen cards.

Recording the Data. After the judgements were recorded, the data were organized and transcribed on data sheets according to each criterion, each judge, each specimen, and each judgement (Appendix B). The raw data were then transferred to IBM data cards for statistical treatment.

TABLE V
RANDOM PATTERNS OF THE
SPECIMEN CARDS

Place	Specimen No.	Place	Specimen No.	Place	Specimen No.
P A T T E R N 1					
1	68	31	39	61	60
2	48	32	21	62	34
3	16	33	57	63	63
4	73	34	47	64	28
5	13	35	11	65	87
6	9	36	19	66	1
7	55	37	8	67	70
8	52	38	18	68	22
9	29	39	38	69	35
10	6	40	51	70	40
11	62	41	82	71	12
12	33	42	42	72	3
13	88	43	36	73	31
14	69	44	89	74	4
15	86	45	10	75	23
16	27	46	58	76	41
17	15	47	76	77	24
18	26	48	37	78	44
19	14	49	61	79	53
20	2	50	32	80	75
21	50	51	66	81	7
22	90	52	5	82	49
23	46	53	59	83	67
24	54	54	72	84	84
25	65	55	56	85	74
26	25	56	80	86	78

TABLE V (Continued)

Place	Specimen No.	Place	Specimen No.	Place	Specimen No.
P A T T E R N 1					
27	20	57	64	87	71
28	17	58	30	88	79
29	85	59	77	89	81
30	43	60	45	90	83
P A T T E R N 2					
1	54	31	82	61	65
2	75	32	42	62	63
3	78	33	52	63	62
4	33	34	35	64	37
5	3	35	21	65	9
6	25	36	26	66	32
7	34	37	44	67	85
8	87	38	50	68	84
9	16	39	5	69	47
10	66	40	8	70	89
11	15	41	60	71	24
12	17	42	59	72	46
13	77	43	76	73	49
14	58	44	14	74	72
15	70	45	27	75	23
16	13	46	39	76	4
17	61	47	22	77	69
18	10	48	19	78	86
19	45	49	74	79	36
20	30	50	2	80	7
21	90	51	40	81	18

TABLE V (Continued)

Place	Specimen No.	Place	Specimen No.	Place	Specimen No.
P A T T E R N 2					
22	11	52	55	82	28
23	41	53	88	83	81
24	12	54	57	84	38
25	56	55	79	85	80
26	20	56	43	86	68
27	31	57	1	87	83
28	29	58	67	88	53
29	73	59	71	89	51
30	64	60	6	90	48
P A T T E R N 3					
1	3	31	80	61	77
2	70	32	53	62	38
3	66	33	49	63	18
4	19	34	13	64	74
5	10	35	25	65	63
6	85	36	28	66	75
7	40	37	23	67	56
8	16	38	29	68	89
9	44	39	31	69	48
10	82	40	37	70	12
11	72	41	9	71	67
12	64	42	7	72	1
13	4	43	60	73	81
14	47	44	65	74	62
15	52	45	39	75	57
16	22	46	24	76	6

TABLE V (Continued)

Place	Specimen No.	Place	Specimen No.	Place	Specimen No.
P A T T E R N 3					
17	33	47	46	77	21
18	59	48	58	78	17
19	20	49	50	79	88
20	26	50	2	80	73
21	68	51	34	81	41
22	69	52	35	82	51
23	15	53	30	83	5
24	71	54	61	84	78
25	43	55	14	85	84
26	32	56	76	86	8
27	90	57	36	87	11
28	27	58	55	88	86
29	54	59	42	89	87
30	45	60	83	90	79
P A T T E R N 4					
1	37	31	67	61	12
2	40	32	22	62	89
3	9	33	86	63	84
4	45	34	82	64	69
5	77	35	72	65	8
6	25	36	28	66	36
7	11	37	48	67	75
8	50	38	60	68	54
9	3	39	4	69	73
10	5	40	20	20	16
11	26	41	47	71	56
12	14	42	41	72	13
13	32	43	30	73	87

TABLE V (Continued)

Place	Specimen No.	Place	Specimen No.	Place	Specimen No.
P A T T E R N 4					
14	70	44	52	74	42
15	1	45	61	75	44
16	35	46	21	76	33
17	15	47	64	77	74
18	19	48	58	78	79
19	43	49	59	79	88
20	85	50	57	80	39
21	78	51	2	81	49
22	62	52	90	82	80
23	17	53	23	83	10
24	63	54	38	84	51
25	65	55	24	85	81
26	55	56	27	86	83
27	29	57	46	87	53
28	6	58	68	88	34
29	71	59	76	89	7
30	31	60	66	90	18
P A T T E R N 5					
1	72	31	84	61	15
2	50	32	14	62	19
3	48	33	46	63	57
4	28	34	62	64	23
5	61	35	89	65	85
6	87	36	40	66	73
7	18	37	74	67	71
8	22	38	81	68	76

TABLE V (Continued)

Place	Specimen No.	Place	Specimen No.	Place	Specimen No.
P A T T E R N 5					
9	38	39	31	69	55
10	49	40	56	70	17
11	10	41	34	71	45
12	12	42	78	72	39
13	75	43	44	73	29
14	20	44	82	74	43
15	83	45	11	75	13
16	70	46	90	76	67
17	88	47	26	77	3
18	41	48	58	78	4
19	69	49	35	79	7
20	63	50	77	80	8
21	5	51	51	81	64
22	54	52	21	82	86
23	52	53	27	83	79
24	24	54	6	84	37
25	80	55	68	85	53
26	60	56	66	86	1
27	9	57	30	87	32
28	16	58	59	88	42
29	25	59	33	89	65
30	47	60	2	90	36

Because of the volume of information, the data were checked for human error both manually and with a special program written for the 7040 IBM computer. All errors were located and corrected before the data were subjected to multiple linear regression analyses.

The Analysis of the Data

The data were analyzed by means of multiple regression models using a modified Reg-200 program in the 7040 IBM computer. This program was prepared by a statistician in the Division of Educational Research and was used for all analyses in the study.

The analysis of the data proceeded in three steps: (1) deriving the means of thirty ratings for each specimen for each criterion; (2) finding the correlation coefficients; (3) subjecting the average ratings to multiple linear regression analysis. The hypotheses were accepted or rejected at the .01 level of significance.

Summary

Chapter III has dealt with the research plan for this study. The pilot study determined and tested the methods and materials to be used in this study. The handwriting samples were written by 262 grade five students in three schools located in a middle class residential area of the Edmonton Public School System. The handwriting samples were all written in accordance with specific directions given by the investigator.

The ninety handwriting specimens in the study were randomly selected from 257 handwriting samples (five samples had been discarded) and were mounted on specimen cards. Using a continuum

of handwriting quality the ninety handwriting specimen cards were judged by thirty competent teachers of grades four, five, and six in the Edmonton Public School System. Each teacher judged the quality of the handwriting specimens using the same procedures for general appearance, spacing, letter formation, slant, and legibility, in that order, and according to specified directions administered by the investigator. Each judgement or rating was recorded on a data grid and later transcribed on a data sheet for each criterion. These values were recorded on IBM computer cards for statistical analysis. The data were subjected to multiple linear regression analysis using a modified Reg-200 program in the 7040 IBM computer.

CHAPTER IV

THE FINDINGS

Introduction

Chapter IV is concerned with the analysis of the average ratings which were derived from the judgments of thirty teachers resulting from the rating of ninety specimens of grade five handwriting. During five different sessions the judges rated the specimens for general appearance, spacing, letter formation, slant and legibility, separately and in that order.

A value for each specimen was derived with the aid of a "continuum of handwriting quality," described in Chapter III. Using this guide, each judge established five ratings for each handwriting specimen (Appendix B). For the statistical procedures designed for this study, the teachers' judgments were considered the population from which the means for each specimen were drawn (Appendix C). The average ratings were submitted to multilinear regression analysis using programs developed by the Department of Educational Research, Faculty of Education, University of Alberta.

So that the teachers' judgments might be viewed in perspective, a criterion variable, general appearance, representing the way teachers usually rate handwriting, was established. General appearance ratings were investigated and related to teachers' ratings based on letter formation, slant, spacing, and legibility as separate criteria. The average ratings on general appearance were adjusted for the effects of the prediction variables when combined with the effects

of all combinations of the factors of letter formation, spacing, slant and legibility. Similarly the average ratings on legibility were adjusted for the effects of the prediction variables when combined with all combinations of letter formation, spacing, and slant.

The Analysis

The hypotheses to be tested were stated in Chapter III, page 44. The relationships among the five average ratings for each of the ninety handwriting specimens were investigated through the multilinear regression analysis. The results of the statistical analysis were compiled in Tables VI, VII, and VIII. Table VI, a correlation matrix, shows the correlation coefficients. Tables VII and VIII show the results of the regression analysis. A subjective analysis summarized in Table IX presents logical support for the statistical findings in Tables VI, VII and VIII.

In the analysis the correlation coefficients were tested for significance at the .01 level of significance. The hypotheses were accepted or rejected at the .01 level of significance.¹

Correlation Matrix. The correlation matrix, Table VI, shows that there was a high positive correlation among the variables of general appearance, letter formation, spacing, slant and legibility. All the variables were significant at the .01 level of significance. Among the five variables slant correlated least highly with the other variables.

¹Fred N. Kerlinger, Foundations of Behavioral Research. Holt, Rinehart and Winston, Inc., New York, 1965, p. 171.

General Appearance. Table VII shows the relationship of the prediction variables of letter formation, spacing, slant and legibility to that of general appearance, or the way teachers usually rate handwriting. This relationship was tested when the effects of all combinations of letter formation, spacing, slant and legibility were included. Using the .01 level of significance as the critical value, twenty five null hypotheses were rejected and seven were accepted. There were thirty two sub-hypotheses tested in relation to the major hypotheses with general appearance as the criterion. Twenty five F-ratios were large enough to allow the rejection of the null hypotheses. The seven null hypotheses that were accepted had in common the fact that the prediction variables, legibility, spacing and slant, adjusted for the effects of certain combinations of the variables, were not significant predictors of the way teachers usually rate children's handwriting. Letter formation as a prediction variable was always a significant predictor of general appearance.

TABLE VI
CORRELATION MATRIX

Variables	General Appearance	Letter Formation	Spacing	Slant	Legibility
Gen. App.	1.0000	0.9691	0.9088	0.8764	0.9368
Letter Form.		1.0000	0.8984	0.8713	0.9450
Spacing			1.0000	0.7781	0.9231
Slant				1.0000	0.7824
Legibility					1.0000

TABLE VII

RESULTS OF MULTILINEAR REGRESSION ANALYSES RELATING THE PREDICTION
 VARIABLES, LETTER FORMATION, SPACING, SLANT AND LEGIBILITY, TO THE
 CRITERION, GENERAL APPEARANCE

Prediction Variable	Tested in Combination With	df	F-Ratio	Probability ^a
letter formation	-	1.89	1375.6146	0.00000
spacing	-	1.89	422.2705	0.00000
slant	-	1.89	294.7886	0.00000
legibility	-	1.89	637.7386	0.00000
spacing	letter formation	1.88	12.4787	0.00066
letter formation	spacing	1.88	199.8370	0.00000
slant	letter formation	1.88	6.6089	0.01183 ^{ns}
letter formation	slant	1.88	273.0466	0.00000
legibility	letter formation	1.88	6.3732	0.01338 ^{ns}
letter formation	legibility	1.88	102.1926	0.00000
slant	spacing	1.88	63.0160	0.00000
spacing	slant	1.88	113.1785	0.00000
legibility	spacing	1.88	52.1150	0.00000
spacing	legibility	1.88	10.5728	0.00163
slant	legibility	1.88	67.2899	0.00000
legibility	slant	1.88	206.0555	0.00000
slant	letter formation, spacing	1.87	8.0315	0.00571
spacing	letter formation, slant	1.87	13.9275	0.00034

TABLE VII (Continued)

Prediction Variable	Tested in Combination With	df	F-Ratio	Probability ^a
letter formation	slant, spacing	1.87	94.1303	0.00000
legibility	letter formation, spacing	1.87	0.8312	0.36446 ^{ns}
spacing	letter formation, legibility	1.87	6.5135	0.01245 ^{ns}
letter formation	legibility, spacing	1.87	93.4308	0.00000
legibility	letter formation, slant	1.87	12.2207	0.00075
slant	letter formation, legibility	1.87	12.4686	0.00066
letter formation	legibility, slant	1.87	34.8250	0.00000
legibility	spacing, slant	1.87	47.7900	0.00000
spacing	legibility, slant	1.87	5.2168	0.02480 ^{ns}
slant	legibility, spacing	1.87	58.2767	0.00000
legibility	letter formation, spacing, slant	1.86	3.4433	0.06693 ^{ns}
slant	letter formation, spacing, legibility	1.86	10.7758	0.00149
spacing	letter formation, legibility, slant	1.86	4.9819	0.02821 ^{ns}
letter formation	legibility, slant, spacing	1.86	34.1936	0.00000

^aNon-significant results indicated by ns.

Legibility. Table VIII shows the relationship of the prediction variables of letter formation, spacing and slant to the criterion of legibility. These relationships were tested when all possible combinations of the factors of letter formation, spacing and slant were included. As in Table VII the null hypotheses were accepted or rejected at the .01 level of significance. Of the twelve sub-hypotheses, ten were rejected and two were accepted.

The two null hypotheses that were accepted occurred when slant was the prediction variable and was tested in combination with spacing and with letter formation. Letter formation was always a significant predictor of legibility.

The Subjective Analyses

Table IX shows the average ratings for the ninety handwriting specimens ranked from poorest to best for each criterion used by the judges. This subjective analysis presents logical support for the findings in Tables VI, VII and VIII.

While Table IX shows a close relationship among the average ratings for all five criteria, it reveals that no specimens having other than forward slant was highly rated when slant was the referent for rating the handwriting specimens. The term "other than forward slant" refers to handwriting having perpendicular or back slant. Of the ninety handwriting specimens rated for slant, about twenty four per cent had other than forward slant.

Table IX also revealed that about seventy seven per cent of the specimens having other than forward slant were placed below the forty-fifth place, the mid-point, on the ninety place range. Specimen

TABLE VIII

RESULTS OF MULTILINEAR REGRESSION ANALYSES RELATING THE PREDICTION VARIABLES,
LETTER FORMATION, SPACING AND SLANT, TO THE CRITERION, LEGIBILITY

Prediction Variable	Tested in Combination With:	df	F-Ratio	Probability ^a
letter formation	-	1.89	742.5695	0.00000
spacing	-	1.89	512.7924	0.00000
slant	-	1.89	140.5028	0.00000
spacing	letter formation	1.88	31.9507	0.00000
letter formation	spacing	1.88	77.7504	0.00000
spacing	slant	1.88	160.2877	0.00000
slant	spacing	1.88	6.6883	0.01135 ^{ns}
letter formation	slant	1.88	253.0484	0.00000
slant	letter formation	1.88	6.1251	0.01524 ^{ns}
slant	letter formation, spacing	1.87	7.6749	0.00685
spacing	letter formation, slant	1.87	33.6513	0.00000
letter formation	spacing, slant	1.87	78.7269	0.00000

^aNon-significant results indicated by ns.

numbers twenty nine, fifty eight and sixty seven having other than forward slant were the first three specimens to be placed on the continuum of quality when slant was used as a criterion for rating the specimens. While these specimens were placed in the nineteenth, twenty fifth and forty first place under slant, they scored a higher average rating when general appearance, letter formation, spacing, and legibility were used as criteria.

Table IX also shows one overall average or grand mean for each of the ninety handwriting specimens. Using these means, the best as well as the poorest handwriting specimens can be identified. From Table IX handwriting specimen numbers eleven, forty eight and seventy five represented the best handwriting having been placed in the first, second and third place. Handwriting specimen members thirty, fifty four and thirty eight represented the poorest handwriting, having been placed in the eighty eighth, eighty ninth and ninetieth place.

The best handwriting specimens were characterized by uniformity in letter formation, spacing and forward slant (Appendix D). These specimens were also very legible. The poorest handwriting lacked consistency and uniformity of letter formation, spacing and slant (Appendix D). Although not totally illegible, the specimens of poorest handwriting were difficult to read.

The Findings

Seven major hypotheses were tested. The first four hypotheses examined the effectiveness of the prediction variables (letter formation, spacing, slant and legibility), in predicting the way teachers usually rate handwriting (general appearance). The remaining three

TABLE IX
THE AVERAGE RATINGS RANKED FROM
POOREST TO BEST

Place No.	General Appearance	Letter Formation	Spacing	Slant	Legibility	Mean
1	11 ^a	48	11	11	11	11
2	48	11	48	48	48	48
3	33	33	75	33	28	75
4	75	75	29 [*]	53	75	28
5	53	58 [*]	28	28	15	33
6	58 [*]	28	53	27	6	15
7	28	72	15	52	29 [*]	55
8	15	59	86 [*]	22	43	29 [*]
9	17	17	23	72	86 [*]	6
10	42	6	42	42	58 [*]	58 [*]
11	6	29 [*]	71	6	59	72
12	72	86 [*]	59	17	72	42
13	29 [*]	15	21 [*]	23	53	59
14	52	53	25	75	33	23
15	69	69	58 [*]	15	42	52
16	59	42	84	51	23	17
17	43	52	47 [*]	71	51	43
18	41 [*]	23	43	31	84	51
19	51	43	51	29 [*]	76	86 [*]
20	86 [*]	51	6	76	69	69
21	23	41 [*]	52	34	41	71
22	22	71	88 [*]	25	67	25
23	34	27	7	43	47 [*]	27
24	79 [*]	21 [*]	70 [*]	32	52	41 [*]
25	21 [*]	25	41 [*]	58 [*]	18	84
26	88 [*]	8 [*]	79 [*]	59	25	76
27	84	47 [*]	27	5	79 [*]	34
28	71	76	78	68	26	47 [*]
29	27	10	72	10	88 [*]	67 [*]

TABLE IX (Continued)

Place No.	General Appearance	Letter Formation	Spacing	Slant	Legibility	Mean
30	47*	31	69	69	17	21*
31	67*	26	33	83	27	18
32	76	5	18	18	40*	5
33	32	67*	34	78	74*	88*
34	74*	79*	74*	4	14*	32
35	26	34	2	49	2	31
36	70*	88*	67*	80	70*	70*
37	25	84	77*	62	5	79*
38	5	40*	32	84	34	26
39	82*	18	40*	57	71	78
40	40*	14*	8*	16	78	74
41	18	74*	5	67*	32	8*
42	31	70*	82*	70*	7	22
43	62	22	80	2	45	40*
44	8*	32	46*	41*	21*	7
45	78	82*	14*	89	50*	2
46	49	2	19	36	31	82*
47	7	7	76	8*	8*	14*
48	14*	62	31	60	66	62
49	9	78	26	39	82*	83
50	2	66	36	7	77	10
51	46*	83	9	9	46*	80
52	45	80	17	82*	89	77*
53	68	50*	83	86*	62	49
54	83	68	39	26	83	45
55	66	45	89	40*	9	66
56	77*	49	49	47*	56*	9
57	19	46*	45	66	39	68
58	80	77*	35	19	10	50*
59	39	39	4	14*	3*	46*
60	64	64	22	1*	80	39
61	57	44	1*	74*	36	89

TABLE IX (Continued)

Place No.	General Appearance	Letter Formation	Spacing	Slant	Legibility	Mean
62	16	1*	73	50*	49	36
63	10	56*	87	45	64	19
64	4	36	62	77*	44	57
65	44	20	56*	21*	35	16
66	87	9	64	88*	16	64
67	56*	60	66	20	20	44
68	89	19	3*	73	1*	35
69	36	57	16	87	19	20
70	20	89	68	64	57	1*
71	35	4	50*	65	65	56*
72	55	3*	44	44	68	87
73	50*	55	10	35	55	3*
74	73	16	57	79*	22	4
75	3*	73	13	46*	63*	60
76	60	87	37	55	61	73
77	63*	65	60	3*	4	55
78	65	35	65	85	37	65
79	37	37	20	30	87	63*
80	1*	63*	61	61	13	61
81	85	61	55	63*	85	37
82	13	85	63*	12	12	85
83	12	12	24	56*	60	13
84	61	13	85	13	73	12
85	90	81	90	90	81	90
86	81	90	12	24	90	24
87	30	30	81	54	24	81
88	54	24	30	37	30	30
89	24	54	54	81	54	54
90	38	38	38	38	38	38

^aSpecimen Number

*Specimens having other than forward slant

hypotheses examined the effectiveness of the prediction variables (letter formation, spacing, and slant) in predicting quality (legibility) in handwriting. All the hypotheses were accepted or rejected at the .01 level of significance.

General Appearance. The first hypothesis which stated that the factors of letter formation, spacing, slant and legibility taken one at a time are not significant predictors of general appearance, was rejected. The factors of letter formation, spacing, slant, and legibility are significant predictors of general appearance, or, the way teachers usually rate children's handwriting. The correlation coefficients in Table VI and the F-ratios in Table VII report this finding.

The second hypothesis which stated that when scores on general appearance are adjusted for each variable in turn for each other variable, none of the factors of letter formation, spacing, slant and legibility is a significant predictor of general appearance, was not totally rejected. Two parts of the second hypothesis were accepted. It was found that:

- a) Letter formation in combination with spacing, slant, and legibility was a significant predictor of general appearance.
- b) Spacing in combination with letter formation, slant and legibility, is a significant predictor of general appearance.
- c) Slant in combination with spacing and legibility is a significant predictor of general appearance. Under the

same conditions slant in combination with letter formation is not a significant predictor of general appearance.

- d) Legibility in combination with spacing and slant is a significant predictor of general appearance. However, legibility is not a significant predictor of general appearance when in combination with letter formation.

The third hypothesis, which stated that when scores on general appearance were adjusted for all possible pairs of factors for each variable, none of the factors of letter formation, spacing, slant, and legibility is a significant predictor of general appearance, posed a problem similar to that of the second set of hypotheses. Because of the statistical findings one could not clearly accept or reject the complete hypothesis. From an examination of Table VII it was found that:

- a) Letter formation in combination with spacing and slant, spacing and legibility, and slant and legibility was a significant predictor of general appearance.
- b) Spacing in combination with letter formation and slant was a significant predictor of general appearance. However, when spacing was in combination with letter formation and legibility, and slant and legibility, it was not a significant predictor of general appearance.
- c) Slant in combination with letter formation and spacing, letter formation and legibility, and spacing and legibility, was a significant predictor of general appearance.
- d) Legibility in combination with letter formation and slant,

and spacing and slant were significant predictors of general appearance. However, when legibility was tested in combination with letter formation and spacing, it was not a significant predictor of general appearance.

The fourth hypothesis, which stated that when scores on general appearance are adjusted for the three other effects, none of the variables of letter formation, spacing, slant and legibility is a significant predictor of general appearance, was not totally accepted or rejected. It was found that:

- a) Letter formation in combination with spacing, slant, and legibility was a significant predictor of general appearance.
- b) Slant in combination with letter formation, spacing and legibility was a significant predictor of general appearance.
- c) Spacing in combination with letter formation, slant, and legibility was not a significant predictor of general appearance.
- d) Legibility in combination with letter formation, spacing, and slant was not a significant predictor of general appearance.

The findings, when all possible combinations of the prediction variables (letter formation, spacing, slant and legibility) were tested for predictive ability of the way teachers usually rate children's handwriting, or general appearance, are summarized in Tables X, XI, XII and XIII.

Legibility. Hypothesis five, which stated that the factors of letter formation, spacing and slant are not significant predictors of legibility, was rejected. The evidence in Table VI and Table VIII reveal the significance of this finding. One may conclude that the factors of letter formation, spacing, and slant were each significant predictors of legibility.

The sixth hypothesis, which stated that when scores on legibility are adjusted for each factor in turn for each prediction, none of the factors of letter formation, spacing and slant is a significant predictor of legibility, was not totally rejected. Two aspects of hypothesis six were not accepted as significant predictors of legibility as stated in the null hypotheses. It was found that:

- a) Letter formation, in combination with spacing and with slant was a significant predictor of legibility.
- b) Spacing, in combination with letter formation and with slant was a significant predictor of legibility.
- c) Slant in combination with spacing and with letter formation were not significant predictors of legibility.

The seventh hypothesis, which stated that when scores on legibility are adjusted for all possible pairs of factors for each variable, none of the factors of letter formation, spacing and slant is a significant predictor of legibility, was accepted. Therefore, it was found that:

- a) Letter formation in combination with spacing and slant was a significant predictor of legibility.
- b) Spacing in combination with letter formation and slant

TABLE X
LETTER FORMATION AS A PREDICTOR OF
GENERAL APPEARANCE

Predictor ^a		Restrictors ^a	
lf. *	spg. *	spg. and slt. *	spg. , slt. and legty. *
	slt. *	spg. and legty. *	
	legty. *	slt. and legty. *	

*Significant finding

TABLE XI
SPACING AS A PREDICTOR OF
GENERAL APPEARANCE

Predictor		Restrictors	
spg. *	lf. *	lf. and slt. *	lf. , slt. and legty.
	slt. *	lf. and legty.	
	legty. *	slt. and legty.	

*Significant finding

^aAbbreviated predictor and restrictor forms

- lf. - letter formation
- spg. - spacing
- slt. - slant
- legty. - legibility

TABLE XII
SLANT AS A PREDICTOR OF
GENERAL APPEARANCE

Predictor	Restrictors		
slant*	lf.	lf. and spg.	lf. spg. and legty.
	spg.*	lf. and legty.	
	legty.*	spg. and legty.	

*Significant finding

TABLE XIII
LEGIBILITY AS A PREDICTOR OF
GENERAL APPEARANCE

Predictor	Restrictors		
legty.*	lf.	lf. and spg.	lf., spg. and slt.
	spg.*	lf. and slt.*	
	slt.*	spg. and slt.*	

*Significant finding

was a significant predictor of legibility.

- c) Slant in combination with spacing and letter formation was a significant predictor of legibility.

The findings, when all possible combinations of the prediction variables (letter formation, spacing, and slant) were tested for their ability to predict legibility, are summarized in Tables XIV, XV and XVI.

TABLE XIV
LETTER FORMATION AS A PREDICTOR OF LEGIBILITY

Predictor ^a	Restrictors ^a
lf. * spg. * slt. *	spg. and slt. *

*Significant finding

TABLE XV
SPACING AS A PREDICTOR OF LEGIBILITY

Predictor	Restrictors
spg. * lf. * slt. *	lf. and slt. *

*Significant finding

^aAbbreviated predictor and restrictor forms

- lf. - letter formation
- spg. - spacing
- slt. - slant
- legty. - legibility

TABLE XVI
SLANT AS A PREDICTOR OF LEGIBILITY

Predictor	Restrictors
slt. *	spg. and lf. *
spg. *	
lf. *	

Summary

The findings of the study are summarized below:

1. a) The factors of letter formation, spacing and slant were significant predictors of the way teachers usually rate children's handwriting, general appearance, and also of legibility or quality.
b) Legibility viewed as a prediction variable was a significant predictor of general appearance.
2. The factors of letter formation, spacing and slant were significant predictors of legibility.
3. a) It was found that the predictive ability of each factor of letter formation, spacing, slant, and legibility did not increase or decrease as all possible combinations of the variables were tested with general appearance. The particular combinations of variables restricted the ability of the factors to predict general appearance.
b) Similarly, when all possible combinations of the letter formation, slant and spacing were tested for their ability to predict legibility, the particular combinations of the factors restricted their predictive ability.
4. It was found that the majority of the possible combinations of the prediction variables were significant predictors of general

appearance and of legibility. However, there were several restrictions:

a) Spacing combined with: i. letter formation and legibility; ii. slant and legibility; iii. letter formation, slant and legibility was not a significant predictor of general appearance.

b) Slant combined with: i. letter formation; ii. letter formation and spacing; iii. letter formation, spacing and slant was not a good predictor of general appearance.

c) Legibility combined with: i. letter formation; ii. letter formation and spacing; iii. letter formation, spacing and slant was not a significant predictor of general appearance.

d) Slant combined with: i. spacing; and ii. letter formation, was not a good predictor of legibility.

5. Letter formation was found to be a good predictor of general appearance and of legibility, separately and also when tested with all possible combinations of the variables.

6. Because of certain restrictions, spacing was found not as good a predictor of general appearance as letter formation. However, spacing was found to be a good predictor of legibility. As with letter formation, spacing, when tested separately and with all possible combinations of the variables, was a good predictor of legibility.

The subjective analysis gave logical support to the findings. While slant was found to be a good predictor of general appearance and of legibility, it was not as good a predictor as the other variables.

CHAPTER V

SUMMARY, CONCLUSIONS AND IMPLICATIONS

Summary

The purpose of this study was to determine which of the factors of letter formation, spacing, slant and legibility are the best predictors of teachers' usual rating of children's handwriting. This study also investigated the relationship between legibility and the internal elements of letter formation, spacing and slant to discover whether or not general appearance and legibility represent the same qualities in handwriting.

For the purposes of this study 262 handwriting samples were collected from all subjects in grade five in three schools located in a middle-class district of the Edmonton Public School system. The grade five teachers in each of the selected schools collected the handwriting samples according to specified directions. The handwriting samples of five subjects were withdrawn because identification was impossible. Therefore, ninety representative samples of grade five handwriting were randomly selected from the handwriting of 257 subjects.

Every third sentence in each of the ninety representative handwriting samples was identified as a handwriting specimen for this study. Using a continuum of handwriting quality based on Q-Methodology for obtaining a distribution of opinions, thirty judges rated each of the ninety handwriting specimens for each of the factors of general appearance, spacing, letter formation, slant and legibility. Each judge, in separate sessions, rated each specimen five times. An average rating

was derived for each handwriting specimen for each criterion. The average ratings were analyzed using multiple linear regression models.

To view the five factors in perspective, general appearance was considered a criterion variable representing the way teachers usually rate handwriting. Similarly, legibility represented quality in handwriting from the reader's point of view. The statistical treatment of the data resulted in findings summarized below.

1. a) Letter formation, legibility, spacing and slant, separately, and in that order, were significant predictors of general appearance, the way teachers usually rate children's handwriting.
b) Letter formation, spacing and slant were significant predictors of legibility, or, quality in handwriting.
2. a) The predictive ability of each factor of letter formation, spacing, slant, and legibility did not necessarily increase or decrease as all possible combinations of the variables were tested with general appearance. It was the particular combination(s) of the variables that restricted ability to predict general appearance.
b) Similarly when all possible combinations of letter formation, slant and spacing were tested for their ability to predict legibility, the particular combinations of the factors restricted predictive ability of legibility.
3. The majority of all the possible combinations of the

variables were significant predictors of general appearance and of legibility. It was found that spacing, slant and legibility were not significant predictors of general appearance when tested with the following combinations of variables:

- a) spacing combined with
 - i. letter formation and legibility
 - ii. slant and legibility
 - iii. letter formation, slant and legibility;
- b) slant combined with
 - i. letter formation
 - ii. letter formation and spacing
 - iii. letter formation, spacing and slant;
- c) legibility combined with
 - i. letter formation
 - ii. letter formation and spacing
 - iii. letter formation, spacing and slant.

It was also found that slant combined with spacing and with letter formation was not a significant predictor of legibility.

4. Within the scope of this study slant was shown to be a significant predictor of general appearance and of legibility. From a statistical and subjective analysis, slant, as a predictor of general appearance and legibility, was less good than the other four factors. Among the statistical findings, slant correlates least highly with the way teachers usually rate handwriting, and with legibility, quality in handwriting.

5. Letter formation was found to be a good predictor of the way teachers usually rate children's handwriting, and of legibility, or

quality in handwriting, separately and with all possible combinations of the variables.

Conclusions

Several generalizations about the way teachers rate children's handwriting and about the internal elements of legibility were drawn from the findings in this study. These were based on the handwriting population, the judging, and the hypotheses tested.

1. a) From the findings one may conclude that the factors of letter formation, legibility, spacing, and slant were, separately and in that order, good predictors of the way teachers usually rate children's handwriting.
- b) When the internal elements of legibility were tested, letter formation, spacing, and slant, separately and in that order, were good predictors of legibility.

Because of the high correlations among the factors, one may conclude that the teachers tended to be consistent in the way they rated the handwriting specimens. However, one could question the degree to which the judges were able to isolate in their own minds a criterion of quality in handwriting and, using only that referent, rate children's handwriting.

2. a) Under certain conditions the predictive ability of spacing, slant and legibility was restricted by certain combinations of the variables. The predictive ability of letter formation was not restricted by any of the possible combinations of

the variables. Therefore, it was concluded that letter formation is the best of the four variables for predicting the way teachers usually rate children's handwriting.

- b) While letter formation and spacing were good predictors of legibility, slant as a predictor of legibility was restricted by certain combinations of the variables. It was concluded that elements of letter formation and spacing were better predictors of the way teachers rate legibility than was slant.

Whereas the related research maintains that legibility is the single most important quality of handwriting, the average ratings of letter formation were better predictors of the way teachers usually rate children's handwriting.¹ That letter formation was considered by teachers the most important aspect of handwriting, corroborates Herrick and Okada's findings in a survey of present practices in the teaching of handwriting in the United States.² In her evaluation of subjectivity of elementary school teachers in grading handwriting, Rondinella similarly concluded that teachers were primarily influenced by letter formation.³

¹Alberta Government Publication, Interim Elementary Curriculum Guide for Handwriting, Province of Alberta, Department of Education, 1965, p. 5.

²Virgil E. Herrick and Nora Okada, "The Present Scene: Practices in the Teaching of Handwriting in the United States - 1960"; New Horizons for Research in Handwriting, The University of Wisconsin Press, Madison, 1963, pp. 17-21.

³Oreste Rondinella, "An Evaluation of Subjectivity of Elementary School Teachers in Grading Handwriting," English, Vol.

A limitation of this study exists in the degree to which the judges were able to isolate in their minds a certain quality in handwriting and, using only that referent, rate children's handwriting. In 1940 Freeman expressed the opinion that there is no evidence as to what elements of handwriting actually determine the judgements of persons who use handwriting scales.⁴ In this study the internal elements of legibility, letter formation, spacing and slant were investigated to discover whether or not the way teachers usually rate children's handwriting and legibility represent the same qualities in handwriting. From the evidence in the findings it was concluded that the average ratings of letter formation and spacing were better predictors of teachers' rating of legibility than was slant. It was also concluded that the average ratings of letter formation were better predictors of the way teachers usually rate children's handwriting than were spacing and slant.

From the evidence in this study, one could not conclude that general appearance and legibility are the same quality. Each criterion, general appearance and legibility, seemed to possess aspects of the other but the two criteria did not seem to be the same. Similar to Quant's conclusion, reported in Andersen, legibility appeared to be a composite of simple elements.⁵ Yet letter formation was the best

XL, May 1963, pp. 531-532.

⁴Frank N. Freeman, "Handwriting," Encyclopedia of Educational Research, Walter S. Monroe, ed., MacMillan Co., New York, 1941, pp. 555-61.

⁵Dan W. Andersen, "Handwriting Research: Movement and

predictor of teachers' rating of children's handwriting.

From a subjective analysis of the average ratings of the handwriting specimens, Table VII, the best handwriting represented by specimen numbers eleven, forty-eight and seventy-five tended to be characterized by uniformity in letter formation, spacing, and forward slant (Appendix D). These specimens were very legible. Similar to findings by Lane and Peltola the best handwriting specimens tended to have letters which were of large size and were also well formed.⁶

The poorest handwriting, Table VII, represented by specimens number thirty, fifty-four and thirty-eight, tended to lack consistency and uniformity of letter formation, spacing and slant (Appendix D). While these specimens of handwriting were not totally illegible, they were difficult to read.

It was previously demonstrated that legibility is a better objective of handwriting instruction than is an emphasis on a unitary internal quality such as letter formation. In this study, letter formation was a better predictor of the way teachers usually rate handwriting than was legibility. This would seem to illustrate that the teachers studied do not use legibility as the major criterion in evaluating handwriting.

Quality, " Research on Handwriting and Spelling, National Council of Teachers of English, Champaign, Illinois, 1966, p. 16.

⁶ Patricia Lane and Bette J. Peltola, "A Study of the Handwriting of Left and Right Handed Fourth Grade Writers," (unpublished Colloquium Paper, Faculty of Graduate Studies, University of Minnesota, 1965), p. 112.

Implications and Recommendations

Within the limitations specified, the findings and conclusions of this study have several implications for the process used by teachers to evaluate children's handwriting. These implications would affect not only the way teachers rate children's handwriting, but also teacher education and educational leadership on the part of teachers and administrators in primary and elementary schools.

1. In this study letter formation, legibility, spacing and slant, separately and in that order, were significant predictors of the way teachers usually rate children's handwriting. As a unitary criterion letter formation was a better predictor than legibility. If teachers are not using as their major criterion of quality the one advised in the curriculum guide for elementary schools, there may need to be a re-examination of policy or, if the policy is desirable, there may need to be inservice training.⁷

2. Knowledge of the factors of good handwriting would add to teachers' confidence in their concept of handwriting. This knowledge would not only be significant when evaluating handwriting but might add to the quality of handwriting instruction. Improvement of handwriting instruction could help children cope with the problems of written communication within the framework of current technological and scientific advances.

⁷ Alberta Government Publication, Interim Elementary Curriculum Guide for Handwriting, Province of Alberta, Department of Education, 1965, p. 5.

Again inservice programs within schools and school systems could devote some time to new developments in methods of handwriting instruction so that teachers would gain knowledge of the elements of good handwriting. An inservice program in handwriting instruction and evaluation would also establish a liaison between teachers in the classroom and with the administrators who would, as in other educational matters, give impetus to the improvement of instruction in handwriting.

Further Research

At present there is a lack of handwriting research in Alberta. To date two pieces of research have been reported. They are MacKay's unpublished Thesis, 1962, A Study of Handwriting in Division Two, and this study, Teachers' Rating of Legibility in Handwriting, 1968. Hume of Saskatoon, Saskatchewan, published a handwriting scale in 1957. The following suggestions for further research may increase knowledge of handwriting and contribute to the improvement of handwriting instruction.

1. Among the limitations of this study was the question as to the degree to which a judge was able to isolate in his own mind a criterion of quality in handwriting and using only that referent rate children's handwriting. Since within-judge characteristics were not dealt with in this study, further research involving interaction would add to the validity of this study.

2. A more detailed study of each of the internal elements of legibility may contribute to the overall knowledge of legibility and

of handwriting. A better knowledge of slant in relation to legibility and handwriting could improve handwriting instruction and evaluation.

3. The subjective analyses in this study suggests there may be bias on the part of some teachers when rating children's handwriting for slant. Further research in this area may clarify this point and contribute to the knowledge of the process used by teachers when rating children's handwriting.

4. A survey describing the present practices in the teaching of handwriting in Alberta may provide areas for further research in handwriting.

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APPENDICES

APPENDIX A
SUPPLEMENTARY ILLUSTRATIVE MATERIALS

ITEMS IN APPENDIX A

	PAGE
INSTRUCTIONS.	107
Letter to the principal.	107
Letter to the grade five teacher.	108
A fifth grade handwriting study, directions for administration.	109
INSTRUMENTS FOR COLLECTING DATA	110
Information about the judges	110
Grid for recording judges' ratings of the handwriting specimens	111
Checklist.	112

Department of Elementary Education
University of Alberta, Edmonton
February 21, 1967

To: Mr. principal of School

From: Gordon A. Orlick, graduate student

RE: A Study of Fifth Grade Handwriting

My purpose in coming to your school is to collect handwriting specimens from all the fifth grade students in your building for a handwriting study. Since I have been a classroom teacher and an administrator I appreciate the significance of a request for "just a few minutes" of your time. Therefore I have tried to keep the process of collecting handwriting specimens as simple as possible.

The directions for collecting the specimens are enclosed in the instructions to the teachers. To maintain consistency among the handwriting specimens I would appreciate having the specimens taken during the week of February 27, 28, March 1, 2 or 3, preferably during a regular handwriting period.

Brown manilla envelopes containing instructions to the teachers, foolscap, and a checklist have been provided for the specimens from each class. The teachers should place the handwriting specimens in the envelopes and return them to your office by Friday, March 3, 1967. I would like to collect the envelopes from you during the afternoon of the same day. Would you please distribute and collect the envelopes?

Thank you for your interest and time. I appreciate the cooperation and assistance extended to me by the Edmonton Public School system and by the members of your staff. As soon as the findings of this study have been determined I will forward a copy of the abstract to you.

Yours truly,

Gordon A. Orlick

GAO/lb

Department of Elementary Education
University of Alberta, Edmonton
February 21, 1967

TO: , grade five teacher, School

FROM: Gordon A. Orlick, graduate student

RE: A Study of Fifth Grade Handwriting

My purpose in requesting your assistance is to collect handwriting specimens from all the grade five students in your school for a handwriting study. Since I have been a classroom teacher I appreciate the significance of a request for "just a few minutes" of your time. Therefore I have tried to keep the process of collecting handwriting specimens as simple as possible.

The directions for collecting the handwriting specimens are enclosed in the brown manilla envelopes. I have also enclosed a pad of foolscap. To maintain consistency among the handwriting specimens I would appreciate having the specimens taken during the week of February 27, 28, March 1, 2 or 3, if possible during a regular handwriting period. After the handwriting specimens have been taken and you have completed the check list for your class, please place these materials inside the brown manilla envelope and return it to your principal by Friday, March 3, 1967. I will collect the envelopes from your principal during the afternoon of the same day.

The sentence to be written is simple enough that it should require only discussion. Thus dictation, concentrated memorization, and copying are not necessary. However, at no time should the sentence be printed or written on the board. This will help remove the bias that would come if the children copied from a model. The children should not worry about spelling.

Thank you for your interest and time. I appreciate the cooperation and assistance you have extended to me. As soon as the findings have been determined I will forward a copy of the abstract to you.

Yours truly,

Gordon A. Orlick

A Fifth Grade Handwriting Study

Directions for Administration

- A. Time: February 13, 14, 15, 16 or 17, 1967, - preferably during a regular handwriting period.
- B. Materials:
1. The regular blue line pink margin foolscap. A pad of foolscap has been supplied and is found with the check-list in the brown manilla envelope.
 2. The medium ballpoint pen supplied by the Edmonton Public School system.
- C. Administration:
1. CAUTION: At no time should the writing task be printed or written on the board.
 2. a) Read and discuss the sentence to be written with the class.
b) ~~Repeat~~ Repeat the sentence until the children know it.
c) Please do not dictate the sentence to the children as they write.
 3. Have the children put the usual heading and their name on the first line of foolscap.
 4. Have the children leave two lines blank below the heading. On the third line have the children write the sentence. Since an adequate number of specimens is required, please ask the children to write the sentence four times in all, leaving a two-line space between the sentences.
 5. I would like to have these specimens regardless of spelling errors, erasures or any other writing problems which may arise.
- D. The Writing Task: The sentence to be written is:
- The quick brown fox jumps over the lazy dog.
- E. Checklist:
- Please record the required information and anything you may wish to add under "comments."
- F. Please return the materials using the procedure outlined in the covering letters.

Thank you.

G. Orlick

Page _____

Information about the Judge

No. : _____

Date: _____

Name of Judge: _____

Sex: (M or F) _____

Handedness: (L or R) _____

Grade(s) in which presently teaching: _____

Years of teaching experience: (Check one)

1 _____; 2 _____; 3 _____; 4 _____; (5-9) _____; (10-15) _____;

(16-20) _____; more than 20 years _____.

Teaching certificate presently held _____

Judge's Ratings of the Handwriting Specimens

Page _____

Judge: _____ No. _____

[illegible][illegible]

APPENDIX B

THE JUDGES' RATINGS OF THE HANDWRITING SPECIMENS
FOR GENERAL APPEARANCE, LETTER FORMATION,
SPACING, SLANT AND LEGIBILITY

ITEMS IN APPENDIX B

PAGE

The judges' ratings of the handwriting specimens
for general appearance. 115

The judges' ratings of the handwriting specimens
for letter formation 120

The judges' ratings of the handwriting specimens
for spacing 125

The judges' ratings of the handwriting specimens
for slant 130

The judges' ratings of the handwriting specimens
for legibility 135

THE JUDGES' RATINGS OF THE
HANDWRITING SPECIMENS FOR
GENERAL APPEARANCE

Specimen Nos.	Judges' Numbers																													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1	4	6	4	2	4	3	5	3	4	3	3	4	4	2	2	1	3	2	6	4	3	4	3	3	2	5	3	2	7	4
2	4	7	6	6	8	5	7	4	6	5	7	6	4	7	6	4	6	6	6	6	4	5	7	5	7	6	4	8	4	
3	4	3	3	3	4	6	7	4	3	4	4	3	3	3	6	4	4	4	5	5	5	5	3	4	4	3	3	5	4	
4	3	6	6	4	5	6	2	6	4	4	6	5	9	6	5	4	4	5	4	5	4	5	4	6	5	4	5	7	5	4
5	9	5	7	7	5	7	6	5	8	6	5	8	5	7	6	5	9	8	6	7	7	8	7	4	8	6	6	5	9	6
6	7	9	8	8	10	8	8	9	9	8	9	6	7	8	7	10	7	9	7	8	7	9	7	9	9	9	10	9	6	8
7	4	9	5	6	8	5	7	5	8	5	7	7	5	6	4	7	5	7	5	5	5	4	6	7	5	4	7	7	5	5
8	6	4	9	6	8	3	5	6	5	10	4	4	11	5	7	6	5	5	10	8	6	7	4	6	6	6	8	6	4	4
9	7	6	8	5	4	5	5	5	6	5	4	6	2	6	6	5	6	6	6	6	5	7	5	9	6	7	5	6	6	7
10	7	4	3	5	4	5	6	5	7	4	6	7	1	5	7	5	9	3	5	4	7	4	6	2	3	5	4	4	6	6
11	11	8	10	10	11	11	11	10	11	11	11	10	10	11	11	11	11	11	11	9	11	10	11	6	7	11	11	11	11	11
12	3	3	2	4	4	6	2	3	3	4	3	2	4	4	2	2	5	3	4	2	3	2	2	5	2	4	3	2	4	3
13	2	4	4	4	4	4	3	3	3	2	4	2	5	2	4	3	3	3	3	3	1	3	3	6	3	3	3	3	5	3
14	4	6	8	6	5	5	4	9	6	5	5	8	6	5	8	6	5	5	6	5	6	6	5	6	6	6	4	6	7	5
15	10	8	10	7	7	7	9	7	10	8	9	9	9	8	8	10	10	10	9	11	8	9	11	9	11	9	11	6	9	8
16	5	6	4	4	5	5	4	4	5	4	7	5	6	6	5	5	4	6	4	6	6	5	3	10	2	5	7	8	1	6
17	7	8	9	8	9	9	8	11	7	9	10	9	10	7	6	10	8	8	9	5	10	9	8	11	6	9	8	8	7	11
18	8	7	5	7	6	6	6	6	6	7	7	8	8	7	7	4	4	4	6	6	5	4	6	7	7	7	9	5	8	8

THE JUDGES' RATINGS OF THE
HANDWRITING SPECIMENS FOR
GENERAL APPEARANCE (Continued)

Specimen Nos.	Judges' Numbers																													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
19	4	5	5	6	6	5	6	6	2	6	8	4	7	5	5	7	6	3	5	5	7	6	6	4	4	5	6	3	4	8
20	3	6	4	4	3	6	4	7	6	4	5	4	7	4	5	6	3	5	4	4	5	5	5	6	4	2	6	5	5	5
21	6	7	7	9	5	9	6	7	5	8	8	6	7	8	7	9	7	9	7	8	9	7	8	4	8	8	6	10	5	5
22	8	8	8	9	6	8	7	10	4	9	7	6	8	6	9	6	6	7	8	6	9	7	8	11	7	5	5	7	8	7
23	8	6	9	7	7	8	8	7	10	5	6	11	4	7	8	8	10	6	9	7	8	10	7	5	6	7	6	8	9	7
24	1	3	1	1	2	3	2	1	1	3	3	2	3	1	1	1	3	2	2	1	3	3	2	1	1	1	2	1	4	2
25	7	7	6	5	9	7	7	6	7	8	6	7	8	6	6	5	6	6	7	8	7	8	6	3	7	6	8	9	8	7
26	6	6	7	8	9	5	7	9	6	9	6	7	6	8	6	9	7	6	7	7	7	6	7	6	6	8	7	6	7	5
27	8	6	6	10	7	7	9	5	9	5	7	9	3	3	8	9	11	5	10	7	9	8	9	4	4	6	4	5	7	9
28	10	10	9	8	9	9	8	6	9	8	9	9	11	10	11	8	10	8	8	7	6	9	9	9	11	10	9	8	11	8
29	10	10	6	8	7	9	9	7	9	8	8	10	6	10	7	6	8	10	9	11	8	8	7	6	7	8	8	7	8	8
30	2	3	2	3	3	1	3	2	2	1	1	1	1	1	2	2	2	2	2	2	2	1	1	4	4	3	2	2	4	2
31	5	7	4	7	7	6	9	6	7	8	9	7	9	4	4	9	1	6	5	6	6	6	4	8	5	5	6	7	8	9
32	6	4	5	9	6	6	9	7	7	6	9	6	7	7	6	5	6	5	8	8	9	6	9	9	7	7	9	5	6	7
33	11	7	8	11	11	10	11	11	10	8	8	11	8	11	9	7	11	11	10	10	11	11	9	10	7	10	9	11	10	11
34	8	7	7	10	7	10	6	5	8	7	7	4	7	9	7	7	8	9	7	8	10	10	9	8	8	6	5	7	3	6
35	6	2	6	4	5	4	4	7	5	6	5	7	5	4	3	4	4	4	3	4	4	6	6	4	6	6	4	3	3	5
36	4	6	7	3	5	4	6	4	7	4	6	4	6	4	5	6	5	6	2	3	2	6	2	6	5	3	6	5	6	6

THE JUDGES' RATINGS OF THE
HANDWRITING SPECIMENS FOR
GENERAL APPEARANCE (Continued)

Specimen Nos.	Judges' Numbers																													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
37	3	5	3	3	6	4	3	3	1	2	2	3	4	4	4	5	3	5	4	3	5	2	3	7	3	4	5	4	2	3
38	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	1	1	1	1	1	4	1
39	4	7	4	5	6	6	6	4	5	5	5	7	6	3	5	8	4	5	3	3	4	4	4	8	6	4	7	6	6	7
40	6	4	7	6	6	6	7	9	6	6	5	5	5	7	6	6	7	7	6	5	7	7	6	7	10	7	6	7	6	7
41	7	8	10	6	10	8	8	8	9	10	8	5	7	8	9	6	7	7	7	6	7	8	7	8	10	9	8	7	7	6
42	7	9	8	9	5	9	10	7	9	7	7	9	8	8	9	8	8	7	8	9	7	8	10	8	9	9	8	9	8	9
43	7	10	6	6	7	5	8	8	8	9	10	9	6	9	8	8	7	7	5	10	6	7	8	8	8	9	10	7	9	9
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47	6	6	11	6	6	6	7	7	6	9	6	8	9	8	8	7	5	7	7	7	6	7	8	4	4	6	7	9	10	6
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53	9	7	7	10	10	9	8	9	8	10	10	11	9	11	9	10	7	9	7	10	11	10	7	10	7	8	10	10	8	10
54	1	1	1	3	4	3	2	1	2	2	2	2	2	2	2	2	1	3	1	2	2	1	1	3	2	1	2	2	4	1

THE JUDGES' RATINGS OF THE
HANDWRITING SPECIMENS FOR
GENERAL APPEARANCE (Continued)

Specimen Nos.	Judges' Numbers																													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
55	5	5	4	6	5	3	1	5	5	3	3	3	7	5	6	6	6	4	8	3	3	4	5	8	5	3	5	4	4	2
56	5	5	7	4	3	4	5	5	4	5	4	5	7	5	5	6	6	5	5	4	3	3	4	6	6	7	5	6	6	1
57	6	3	5	6	6	5	5	5	5	3	6	4	7	5	3	6	7	5	4	5	6	5	5	6	4	5	4	6	6	6
58	10	6	7	9	8	10	8	9	8	11	8	10	10	9	9	11	9	10	10	9	8	9	10	5	9	11	8	10	10	10
59	9	9	8	7	9	7	10	6	8	7	8	6	9	8	8	5	9	8	8	9	8	8	8	6	7	10	5	8	8	8
60	5	1	4	4	1	1	5	5	4	4	4	6	8	6	4	4	6	4	4	4	6	5	4	5	1	2	2	5	5	6
61	4	4	3	2	1	2	5	3	3	4	4	3	2	2	4	5	3	4	4	3	4	3	3	2	3	3	3	3	3	4
62	6	5	7	6	9	6	6	8	6	6	6	4	6	5	6	5	6	7	8	6	6	5	8	3	6	6	4	9	9	7
63	5	2	4	3	3	6	4	2	4	2	2	4	4	3	5	3	5	4	5	5	4	2	5	3	6	3	5	3	3	4
64	5	8	6	5	6	4	3	4	5	7	6	6	2	5	6	3	6	6	6	6	5	5	5	7	5	5	4	6	6	4
65	3	4	3	2	2	2	5	6	4	3	3	3	6	3	3	6	5	3	3	2	1	3	3	5	4	4	5	6	6	5
66	5	7	6	5	6	5	4	6	5	8	5	5	5	4	5	7	7	4	5	6	5	6	5	5	8	7	7	4	4	6
67	7	9	11	7	8	6	7	8	8	6	6	7	7	5	7	5	6	6	7	6	6	6	6	9	8	8	7	6	6	6
68	6	2	5	5	8	6	6	7	7	5	5	4	5	6	3	6	6	5	6	6	9	7	6	7	4	5	3	8	8	7
69	9	11	6	8	8	8	10	7	7	10	8	5	6	6	7	9	8	7	9	8	9	7	7	6	9	9	9	7	7	10
70	6	4	8	8	6	7	6	8	6	7	5	6	8	9	8	7	6	8	7	7	7	7	7	6	8	6	5	5	5	5
71	9	10	5	8	5	8	6	4	10	6	10	8	7	7	7	6	7	8	6	7	8	7	9	3	7	6	7	8	8	7
72	8	6	7	9	7	10	8	8	8	9	11	8	8	9	6	7	8	7	9	8	5	9	10	10	10	7	9	7	7	9

THE JUDGES' RATINGS OF THE
HANDWRITING SPECIMENS FOR
GENERAL APPEARANCE (Continued)

Specimen Nos.	Judges' Numbers																														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	
73	3	6	2	5	5	4	3	5	3	6	5	5	6	4	5	3	1	3	3	4	10	4	4	5	5	3	4	8	5	3	
74	8	8	9	7	5	7	6	8	6	6	8	7	6	7	9	8	7	9	6	7	6	6	6	6	8	8	6	5	6	5	
75	9	7	6	11	8	11	10	10	11	9	8	9	10	10	10	7	9	11	11	11	10	11	11	6	9	10	10	10	11	8	
76	7	7	6	7	8	8	7	6	7	4	7	8	5	7	8	8	9	7	8	8	7	8	6	5	6	7	4	8	7	8	
77	6	5	8	7	4	5	5	4	5	6	4	5	4	4	5	8	6	6	5	5	6	6	8	5	6	5	3	4	6	4	
78	5	11	5	8	8	7	7	6	4	7	6	7	3	5	6	6	5	5	6	6	5	4	7	8	5	7	8	4	6	6	
79	8	4	9	6	6	8	8	9	6	7	4	8	8	8	7	7	8	8	7	9	9	6	6	7	8	8	9	6	7	5	
80	2	8	5	6	4	3	6	7	7	6	6	6	4	6	5	8	4	4	4	8	4	7	4	5	4	2	7	5	5	7	
81	4	2	3	2	2	2	1	2	2	3	2	1	3	3	3	3	3	2	3	1	3	3	3	1	3	2	1	1	4	3	
82	6	4	8	7	6	9	4	5	5	7	7	8	8	8	6	5	7	8	7	7	6	7	8	4	7	6	5	6	6	5	
83	6	3	5	4	7	7	5	4	7	8	5	8	3	6	5	3	4	7	5	7	6	6	4	7	8	5	6	5	4	6	7
84	8	8	5	7	7	7	6	8	9	7	7	7	6	7	7	5	8	7	6	6	7	8	7	7	10	8	7	9	7	6	
85	5	5	4	1	3	2	4	3	4	3	3	6	4	4	3	3	2	1	2	3	3	3	4	2	3	4	4	6	5	3	
86	7	6	11	6	7	8	9	10	6	7	6	6	9	6	10	7	10	8	8	7	7	6	6	4	8	8	7	7	10	8	
87	3	5	2	4	6	4	4	6	3	6	9	3	5	5	4	4	4	6	4	6	5	5	5	7	5	4	6	5	3	7	
88	7	9	9	7	5	7	7	8	6	7	5	5	6	7	10	9	6	8	7	7	8	6	6	7	11	8	8	9	4	5	
89	5	5	5	5	3	4	4	5	6	6	4	5	6	5	4	4	5	4	3	4	4	6	5	7	3	5	6	5	6	6	
90	2	5	3	3	2	3	3	2	3	1	1	3	3	3	1	2	2	1	1	4	2	2	2	2	5	4	1	3	1	2	

THE JUDGES' RATINGS OF THE
HANDWRITING SPECIMENS FOR
LETTER FORMATION

Specimen Nos.	Judges' Numbers																													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1	6	5	5	4	7	4	5	6	4	5	4	6	8	4	6	4	2	4	6	5	6	7	6	4	5	5	6	2	6	4
2	7	7	6	6	9	6	9	7	6	6	5	8	4	5	8	8	6	5	7	4	5	6	4	6	4	5	5	4	8	7
3	4	4	4	3	3	6	4	5	4	5	5	4	5	3	3	4	3	3	6	6	4	5	6	2	9	5	6	5	4	5
4	5	5	5	3	8	5	3	5	4	7	7	5	7	5	4	4	3	5	5	5	5	2	3	4	5	3	6	6	3	5
5	8	6	6	8	7	8	7	6	7	8	7	7	6	7	6	8	10	8	8	8	6	7	8	6	6	6	3	4	8	5
6	7	8	10	9	10	6	8	9	9	8	6	10	8	7	10	10	7	8	6	10	9	7	9	11	8	10	7	10	9	9
7	5	8	5	7	4	4	6	7	7	6	7	7	6	6	6	8	3	6	4	4	5	4	5	8	7	7	8	8	6	7
8	7	6	10	6	6	6	6	8	8	7	4	2	10	6	6	7	4	5	11	8	7	10	8	9	7	11	10	10	7	3
9	6	4	5	5	6	4	6	6	6	6	4	6	3	6	5	5	6	3	5	5	4	6	4	5	4	4	5	6	5	5
10	8	7	6	8	8	7	8	6	7	6	7	9	8	9	7	6	7	6	6	8	8	8	7	3	6	7	7	5	6	9
11	11	9	8	10	9	10	11	8	11	9	10	8	11	11	11	7	11	11	8	10	11	9	11	7	11	10	11	11	7	11
12	3	4	3	3	4	5	3	5	3	3	4	2	4	2	3	2	5	5	3	3	3	4	1	3	4	3	3	3	1	2
13	2	3	3	5	1	2	3	5	2	4	3	3	3	3	3	3	2	2	2	2	2	3	2	3	4	3	6	3	5	3
14	5	9	6	3	6	5	6	9	5	10	7	6	9	7	6	8	6	6	6	7	6	7	5	10	5	4	6	5	8	6
15	8	8	8	9	11	9	9	5	7	8	8	7	8	7	9	8	9	10	7	10	8	9	9	8	10	11	5	8	10	7
16	3	3	3	3	4	3	5	3	7	4	7	5	6	4	6	4	5	4	6	4	5	3	5	3	4	3	4	7	5	4
17	8	9	7	6	8	7	10	10	7	8	10	11	10	8	9	10	7	7	9	9	10	9	10	8	7	9	10	10	6	9
18	5	8	6	5	8	8	8	7	6	5	7	7	6	7	5	6	6	7	5	6	5	4	5	9	8	6	5	6	7	6

THE JUDGES' RATINGS OF THE
HANDWRITING SPECIMENS FOR
LETTER FORMATION (Continued)

Specimen Nos.		Judges' Numbers																													
1		2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	
19	3	5	4	4	7	4	5	6	2	6	6	4	5	5	6	7	6	6	4	4	7	6	5	4	5	4	5	4	3	5	
20	6	3	5	3	5	6	5	6	7	5	6	4	6	5	5	6	4	5	6	3	4	5	3	7	4	6	6	5	3	6	
21	8	5	8	6	6	11	7	9	5	6	7	5	7	7	7	8	9	9	8	6	9	6	7	5	10	6	8	7	7	6	
22	6	6	8	4	5	6	7	9	5	9	8	7	7	4	4	6	6	7	10	5	8	7	6	8	3	6	2	5	8	5	
23	9	10	7	6	11	8	8	2	9	8	8	9	8	7	10	5	8	6	5	7	10	7	10	6	8	8	5	9	10	9	
24	2	1	2	2	1	2	2	5	1	1	2	1	2	3	1	1	2	1	2	1	1	4	3	2	1	1	3	2	2	3	
25	7	6	6	7	7	6	7	5	8	10	5	7	9	8	8	7	7	8	7	8	8	7	3	8	9	8	8	6	7	7	
26	7	5	9	7	6	6	9	9	6	7	6	8	6	5	6	7	7	8	7	7	6	5	7	7	6	7	8	8	9	8	
27	7	7	6	9	7	8	7	4	9	6	8	8	6	7	7	6	8	7	9	7	10	10	9	6	6	8	4	9	7	6	
28	9	11	10	9	8	10	8	9	8	9	8	9	10	10	11	9	10	9	9	9	6	8	9	10	11	8	10	9	11	8	
29	10	9	9	10	11	9	9	4	9	6	8	8	7	10	9	8	11	10	7	7	9	8	11	5	9	8	9	6	7	11	
30	2	3	2	2	4	1	3	1	3	2	3	2	2	1	3	1	2	1	1	3	2	4	2	2	2	2	1	1	1	2	
31	6	6	6	8	8	8	8	4	10	5	9	7	9	7	7	11	5	6	6	6	5	6	6	10	5	4	10	9	4	7	
32	4	7	6	6	6	7	7	4	6	10	7	8	5	4	7	4	7	6	5	9	8	5	6	5	5	8	4	7	6	6	
33	11	9	7	11	10	11	11	11	10	9	9	11	10	11	7	9	10	10	8	4	11	9	9	8	9	9	9	11	8	11	
34	9	5	9	7	7	8	6	5	6	6	8	5	7	7	5	6	8	7	7	6	9	7	7	4	7	5	4	9	6	8	
35	4	4	3	5	6	3	3	6	4	6	3	5	3	4	4	5	5	4	3	5	4	5	4	3	6	4	5	2	5	4	
36	4	6	5	7	4	5	5	7	8	4	6	6	3	5	5	4	3	4	3	2	4	4	4	7	6	4	9	6	3	7	

THE JUDGES' RATINGS OF THE
HANDWRITING SPECIMENS FOR
LETTER FORMATION (Continued)

Specimen Nos.	Judges' Numbers																														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	
37	2	6	3	3	3	4	4	4	7	3	5	4	4	3	4	2	3	3	3	5	4	6	3	4	3	3	3	3	5	4	2
38	1	1	1	1	1	1	1	1	6	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
39	4	6	4	5	4	5	5	3	6	6	4	5	6	6	4	5	4	5	4	3	4	5	4	7	5	5	9	6	6	7	7
40	6	3	5	5	6	7	7	8	8	7	5	5	5	5	6	8	6	8	7	8	7	7	6	6	11	7	5	4	6	5	5
41	6	7	7	8	7	7	6	8	7	9	8	7	4	8	8	8	7	8	10	8	7	6	7	7	7	8	7	7	8	8	8
42	11	10	6	7	7	9	9	6	8	6	9	9	8	8	8	6	9	8	9	9	7	6	10	5	8	9	4	6	8	10	10
43	6	6	8	7	7	6	6	8	7	8	9	10	6	6	6	6	9	8	6	8	7	6	10	6	11	7	8	8	8	8	8
44	5	4	5	5	9	4	4	6	4	4	4	4	6	6	6	6	3	4	6	6	5	3	5	4	5	6	5	6	7	5	5
45	3	7	5	5	5	3	5	8	6	6	5	6	7	6	5	7	5	4	4	5	6	2	4	7	5	6	5	7	6	7	7
46	6	5	7	5	2	8	4	7	5	6	5	5	3	6	6	6	5	8	5	6	4	6	5	6	6	4	4	4	6	5	5
47	7	8	9	6	5	6	9	4	5	8	6	6	9	7	8	6	8	9	5	7	7	8	8	9	8	6	6	7	9	8	8
48	10	11	11	11	8	11	11	11	11	11	11	10	11	11	11	11	8	10	11	11	8	11	9	11	6	11	11	11	11	10	10
49	5	8	7	6	9	5	4	7	4	3	7	3	6	4	5	6	5	4	6	4	3	4	5	6	5	7	6	6	5	5	5
50	6	6	6	6	9	4	4	6	6	4	4	6	5	5	4	5	6	5	6	4	5	6	6	5	6	7	7	4	7	6	6
51	7	7	7	8	8	8	8	8	6	5	7	8	7	8	9	9	9	9	5	8	8	10	8	7	8	6	6	5	7	7	7
52	7	7	9	8	10	9	8	6	8	8	9	9	4	9	9	6	6	9	9	8	8	7	8	5	9	7	8	6	9	8	8
53	7	7	8	8	7	7	7	8	10	10	11	11	7	9	10	8	9	7	5	7	9	11	9	8	9	8	9	7	7	8	8
54	1	2	1	1	2	1	1	1	1	2	3	3	2	1	1	1	2	1	2	1	2	3	1	2	2	1	1	1	2	3	3

THE JUDGES' RATINGS OF THE
HANDWRITING SPECIMENS FOR
LETTER FORMATION (Continued)

Specimen Nos.	Judges' Numbers																													
	1.	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
55	6	4	5	8	4	5	2	3	5	5	1	3	4	4	3	3	4	6	10	2	5	7	6	7	4	4	2	4	4	2
56	6	5	4	6	4	3	6	5	4	4	2	4	8	6	6	5	6	5	6	6	4	3	5	6	5	6	6	6	4	4
57	5	5	5	4	3	5	4	2	6	4	5	6	4	5	3	5	6	6	4	7	6	5	5	6	4	5	5	6	4	6
58	9	8	11	10	7	10	9	10	7	9	9	10	9	10	7	9	9	11	7	10	11	8	11	8	10	9	9	10	10	9
59	10	10	9	11	9	9	8	7	9	9	9	8	9	10	7	10	11	9	9	7	8	8	8	7	9	10	8	7	9	9
60	5	6	4	5	4	3	7	6	5	5	6	6	8	4	4	4	4	3	6	6	5	4	4	6	2	2	4	7	6	6
61	4	2	4	4	3	5	4	5	3	2	3	3	3	3	2	3	5	4	2	6	3	1	3	1	4	4	5	2	5	3
62	8	6	6	7	6	5	6	2	6	4	5	5	5	5	5	5	6	6	5	4	8	6	6	6	6	7	7	8	10	6
63	5	1	2	2	2	4	3	2	3	2	3	3	7	2	5	3	4	3	4	3	3	4	4	4	5	4	6	5	2	3
64	5	4	6	5	3	6	4	6	6	4	6	5	4	6	6	6	6	5	7	5	5	3	5	4	4	6	6	6	4	4
65	4	6	3	5	6	3	5	6	6	7	4	4	4	2	4	4	2	3	4	5	1	4	3	6	3	5	3	5	5	5
66	7	6	7	6	5	4	5	3	6	7	5	4	7	6	7	6	5	6	6	6	5	5	6	6	7	5	7	4	6	6
67	7	7	7	7	6	6	7	4	7	7	5	7	6	6	7	9	8	6	5	7	6	7	8	8	7	9	7	7	7	6
68	6	5	4	6	6	5	6	7	6	3	6	4	5	6	5	4	4	5	5	5	9	5	7	7	3	6	5	7	3	8
69	8	9	8	9	5	9	10	4	9	11	10	7	6	8	6	6	7	8	8	9	9	9	8	9	10	9	9	8	8	10
70	7	2	7	6	6	7	6	9	5	8	5	5	8	8	5	7	7	7	7	6	7	8	6	8	6	5	7	5	7	4
71	9	7	6	6	4	7	7	8	9	8	10	8	7	9	8	4	8	7	7	9	10	7	8	5	7	7	7	8	6	7
72	8	9	9	10	8	9	10	10	11	7	11	6	9	9	9	11	10	8	10	11	7	9	8	10	7	7	8	8	9	8

THE JUDGES' RATINGS OF THE
HANDWRITING SPECIMENS FOR
LETTER FORMATION (Continued)

Specimen Nos.	Judges' Numbers																														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	
73	4	5	4	4	4	6	4	4	5	4	5	6	4	4	5	4	5	3	5	3	6	6	6	5	3	2	3	5	5	3	4
74	9	8	8	9	5	7	6	7	5	5	4	5	5	6	7	7	7	6	5	6	5	6	5	7	4	8	6	7	6	6	7
75	10	7	10	9	9	10	10	8	10	7	8	7	11	9	10	10	9	11	11	11	7	11	10	8	8	10	8	9	9	10	
76	9	7	8	7	7	7	7	4	8	6	7	8	5	8	8	7	8	6	9	8	7	8	7	7	7	8	6	6	7	7	
77	3	5	7	4	5	6	5	5	4	3	5	6	6	6	5	5	6	7	7	7	6	7	6	9	6	6	4	3	4	4	
78	5	11	4	7	6	6	6	4	4	7	6	6	5	5	7	7	5	4	6	6	6	6	6	5	6	7	7	4	5	6	
79	5	5	7	8	5	6	6	10	5	7	6	7	6	8	8	8	7	7	8	6	7	6	6	9	6	5	7	5	8	6	
80	3	8	5	6	5	5	5	7	7	6	6	7	5	5	6	7	6	5	4	4	6	4	4	5	5	7	8	6	5	5	
81	4	2	2	2	3	2	2	7	1	1	2	1	1	3	2	3	4	3	3	1	3	1	2	1	3	2	3	3	3	1	
82	6	3	7	5	5	7	5	6	5	7	8	5	7	7	4	5	7	7	7	6	7	6	7	6	7	7	4	9	7	5	
83	6	4	3	7	8	7	6	7	7	5	3	6	5	5	6	5	5	4	5	6	6	6	7	6	6	6	7	6	4	6	
84	8	6	6	7	7	7	7	4	8	5	7	9	6	7	8	7	6	6	8	9	5	9	6	6	7	6	6	4	6	7	
85	3	3	6	4	5	3	2	3	3	3	2	3	2	3	3	2	4	2	4	3	3	3	3	3	4	5	5	2	3	5	1
86	8	10	11	6	10	8	8	11	5	11	5	9	8	8	9	9	6	9	8	8	6	8	7	7	9	8	11	8	11	9	
87	4	4	4	4	4	6	5	3	5	3	6	6	7	4	4	5	5	5	3	3	5	3	5	5	3	3	4	3	5	4	
88	5	8	8	8	5	8	6	3	5	7	6	6	5	9	7	7	7	8	7	8	7	8	7	9	8	6	6	7	4	6	
89	6	6	5	4	3	6	5	3	8	4	6	6	4	3	5	6	5	4	4	4	4	4	5	5	3	5	3	5	5	4	
90	1	4	1	1	2	2	1	1	2	2	1	3	2	2	2	2	1	2	2	5	2	5	2	4	1	2	2	2	3	2	3

THE JUDGES' RATINGS OF THE
HANDWRITING SPECIMENS FOR
SPACING

Specimen Nos.	Judges' Numbers																													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1	3	5	7	6	8	6	7	4	5	3	5	2	8	3	4	6	6	5	6	4	5	7	5	7	6	4	6	6	4	4
2	6	6	7	7	5	6	7	5	7	7	7	6	8	9	7	8	6	6	8	6	5	9	7	4	8	7	6	5	6	7
3	4	4	4	3	5	6	5	5	6	5	5	7	4	6	3	6	5	5	5	6	5	4	4	3	8	4	6	4	5	6
4	6	8	2	3	7	3	7	6	5	7	9	5	3	6	6	4	6	7	2	6	6	4	5	7	7	4	2	8	6	4
5	10	5	8	6	5	7	6	4	9	5	7	9	2	6	4	5	9	6	5	8	9	4	8	6	9	5	4	4	6	7
6	6	6	6	10	8	8	7	5	8	8	5	5	7	8	9	10	9	6	7	8	5	7	7	8	9	9	9	8	8	8
7	7	10	7	9	10	6	6	11	7	5	11	7	6	9	7	7	6	7	4	5	6	7	6	8	8	8	9	9	4	6
8	6	7	5	5	3	3	7	5	4	10	3	4	9	6	6	7	6	7	11	10	7	7	5	8	6	7	8	10	5	4
9	7	8	9	4	6	4	7	8	4	4	4	6	5	4	5	5	3	4	6	7	6	8	5	9	6	7	7	5	5	6
10	7	3	6	5	2	5	5	4	6	7	4	4	4	2	3	6	4	5	5	4	8	5	5	1	4	7	2	3	7	6
11	11	11	8	7	10	11	11	7	9	9	10	9	11	11	9	10	11	11	10	11	11	11	11	6	11	11	10	8	9	10
12	2	4	4	3	6	1	2	1	1	2	3	1	3	3	8	3	3	3	4	1	3	6	4	5	3	3	5	5	2	1
13	3	6	5	6	3	6	4	4	3	4	4	5	7	5	4	4	3	4	5	2	3	6	3	6	5	3	6	4	4	4
14	5	7	5	4	7	6	5	9	7	7	7	6	8	5	8	4	6	4	6	7	5	7	8	4	4	5	6	5	7	6
15	7	7	7	11	6	9	8	5	9	10	8	8	9	7	7	11	7	8	11	10	7	8	10	9	7	9	10	7	8	7
16	5	6	3	6	3	2	8	6	2	6	6	5	3	5	5	6	6	4	3	5	5	4	4	3	6	6	6	7	3	5
17	11	4	8	5	5	6	6	4	2	9	4	8	6	2	6	8	5	2	6	6	8	6	5	5	5	4	7	6	8	6
18	7	7	9	9	9	7	6	4	7	6	8	6	7	8	7	6	4	6	8	6	6	8	7	8	4	8	7	6	6	8
19	3	6	5	7	7	6	6	8	5	8	7	2	6	7	4	8	8	6	5	6	8	8	6	6	6	5	5	5	4	7

THE JUDGES' RATINGS OF THE
HANDWRITING SPECIMENS FOR
SPACING (Continued)

Specimen Nos.	Judges' Numbers																													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
20	2	3	4	3	3	5	4	6	6	5	5	4	3	5	4	4	3	6	3	4	2	1	3	7	3	3	5	4	7	5
21	8	8	8	8	7	9	9	9	6	9	7	7	7	6	10	5	11	9	9	9	9	7	8	6	8	6	9	7	5	8
22	4	2	6	2	5	1	6	7	10	8	3	8	7	2	3	2	4	6	7	7	6	2	5	10	5	2	4	8	10	7
23	9	8	7	9	7	7	11	7	7	6	9	8	10	11	6	7	9	9	8	6	9	10	11	5	7	8	7	8	10	9
24	4	5	3	5	8	5	3	6	4	1	3	5	3	3	3	2	3	1	2	4	3	5	4	3	3	5	4	2	1	3
25	8	6	6	8	8	8	8	8	8	9	8	7	8	7	6	6	8	8	9	8	6	10	7	9	6	10	10	9	6	6
26	7	9	7	7	3	3	7	6	4	6	5	5	5	5	7	7	3	4	8	3	5	5	7	4	6	7	8	7	7	7
27	11	4	7	8	5	9	10	6	9	4	6	10	4	10	6	5	7	5	9	6	10	6	7	4	6	6	7	8	9	8
28	7	6	9	9	7	9	8	6	10	8	6	7	10	7	11	11	9	11	9	5	5	10	11	11	10	8	11	10	11	9
29	8	10	9	8	10	10	9	11	9	10	9	9	8	11	11	9	8	10	10	9	11	9	8	5	8	9	8	8	9	9
30	1	5	1	5	3	3	3	3	3	4	2	6	3	3	1	3	5	1	1	2	1	5	1	6	1	3	3	1	3	2
31	6	3	7	5	4	9	9	3	10	5	2	9	6	7	6	2	2	6	6	8	6	5	4	7	4	3	4	9	8	10
32	7	6	6	6	5	7	6	9	8	7	8	7	4	8	4	7	9	8	7	7	7	5	8	5	5	7	5	6	5	6
33	7	4	6	1	8	11	6	6	7	5	2	11	7	5	6	5	9	7	8	7	10	2	9	10	9	4	2	11	10	11
34	7	7	10	4	9	10	5	3	9	3	9	6	5	6	7	5	8	8	7	7	10	7	6	5	8	6	5	7	6	6
35	6	7	7	6	4	5	4	5	5	6	6	6	5	5	9	5	6	7	4	6	7	6	6	6	5	5	3	1	5	7
36	4	9	7	6	9	6	5	4	7	6	6	7	6	4	6	6	5	7	3	5	4	7	3	8	7	6	7	5	4	5
37	4	6	5	5	1	6	3	6	1	4	5	3	4	4	4	6	5	5	6	4	4	3	3	6	2	5	3	3	7	3

THE JUDGES' RATINGS OF THE
HANDWRITING SPECIMENS FOR
SPACING (Continued)

Specimen Nos.	Judges' Numbers																													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
38	1	1	1	2	1	1	1	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
39	5	4	6	6	3	7	6	6	10	6	9	6	3	3	5	6	5	5	4	5	6	4	6	6	6	7	6	4	7	
40	8	7	5	7	2	8	8	4	7	5	4	4	6	7	8	9	6	8	9	6	6	6	8	8	7	6	5	4	7	
41	8	10	6	7	4	6	6	7	9	6	6	4	8	8	8	9	8	5	8	4	6	5	9	11	8	9	7	8		
42	10	10	8	6	11	7	10	6	6	8	8	10	9	4	9	7	8	9	9	10	8	8	7	7	8	5	6	7	11	
43	5	7	9	7	7	5	7	9	6	6	8	8	7	10	10	7	7	8	6	8	5	8	8	10	6	9	9	10	7	7
44	4	6	4	10	8	4	4	5	5	6	3	3	5	7	6	6	6	5	6	3	2	4	3	3	6	6	2	3	3	
45	3	6	8	6	6	3	5	9	6	4	5	5	7	8	7	6	4	4	6	5	4	6	6	4	5	5	8	7	4	4
46	5	8	5	7	9	7	8	7	6	6	6	8	5	8	5	6	7	6	7	5	7	8	6	2	5	6	6	4	5	5
47	7	8	11	4	11	8	8	7	5	8	7	8	9	8	5	9	7	8	6	7	7	5	9	11	5	8	4	6	11	10
48	9	9	9	9	6	11	9	8	11	11	8	8	11	9	11	11	5	9	8	11	7	11	9	11	8	11	11	11	8	9
49	5	7	4	7	7	4	3	5	5	6	9	5	5	6	4	4	7	7	4	4	4	7	5	7	5	7	7	6	6	5
50	5	5	4	7	6	5	7	3	4	3	5	3	5	5	5	3	1	5	5	4	3	6	6	5	4	9	5	5	7	4
51	9	6	6	8	6	8	5	7	11	5	8	7	10	8	10	10	8	6	9	6	9	10	9	8	7	6	7	6	5	5
52	10	5	6	4	6	7	10	8	8	6	9	11	4	8	7	8	7	7	7	8	9	4	9	7	10	5	7	8	7	7
53	10	11	7	4	8	8	9	8	6	11	11	8	6	10	9	9	10	10	8	8	9	6	8	9	11	7	8	10	6	9
54	1	3	3	1	4	4	1	1	2	1	2	5	1	1	1	1	3	2	1	2	1	1	1	2	1	1	2	4	2	1
55	3	2	3	7	4	6	1	4	4	3	2	1	8	2	4	2	2	8	6	1	2	5	5	8	4	1	1	2	7	3

THE JUDGES' RATINGS OF THE
HANDWRITING SPECIMENS FOR
SPACING (Continued)

Specimen Nos.	Judges' Numbers																													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
56	5	4	6	6	6	6	4	5	5	7	4	4	6	5	6	3	7	3	6	3	3	6	6	7	4	6	5	8	3	2
57	4	5	3	5	6	2	3	2	3	6	5	6	2	4	5	5	6	4	4	6	6	6	6	7	3	3	3	9	5	
58	7	4	10	4	5	10	8	6	9	5	7	11	7	6	7	6	8	8	9	7	11	3	10	9	11	6	8	9	8	9
59	9	8	9	7	5	10	10	8	8	6	10	7	7	7	7	9	7	9	8	7	7	9	8	6	8	8	6	7	8	9
60	6	1	5	3	4	2	5	10	3	4	1	4	8	4	5	1	4	3	7	3	6	3	2	4	3	4	1	6	6	7
61	4	5	5	4	3	4	4	5	3	5	4	4	3	6	4	3	4	3	3	4	4	2	6	6	5	5	3	2	3	3
62	4	3	5	1	5	5	4	6	8	3	4	9	6	5	2	5	5	6	5	5	8	3	4	6	6	2	5	7	6	8
63	3	5	2	4	7	5	4	3	1	4	3	3	5	5	5	4	4	5	4	6	3	5	4	1	4	4	4	3	2	2
64	6	5	5	7	6	2	3	3	4	8	7	3	4	4	5	6	2	5	5	5	5	6	6	6	7	5	4	5	6	5
65	6	5	6	6	1	4	3	2	5	3	6	2	6	3	6	5	5	3	4	3	4	5	3	5	2	5	4	4	4	5
66	5	5	5	3	2	7	4	5	5	8	3	1	6	4	8	7	5	6	4	3	3	5	5	4	7	4	6	6	7	5
67	5	8	7	6	2	7	8	6	7	7	4	6	6	9	8	9	5	5	7	6	5	6	5	8	7	10	6	9	5	7
68	6	4	1	5	8	5	6	7	6	4	6	6	5	4	9	3	7	2	5	6	7	5	3	3	4	2	6	3	3	5
69	7	3	6	2	4	7	6	6	8	7	10	10	6	8	8	7	7	7	10	8	8	3	7	3	10	6	7	7	9	10
70	8	8	5	5	5	8	5	8	10	7	6	6	9	7	8	6	6	7	7	10	8	7	9	7	6	7	7	6	10	8
71	9	9	4	10	9	6	6	7	8	7	11	7	8	9	9	8	11	9	5	7	9	8	10	10	7	7	8	7	5	6
72	9	6	7	11	4	8	8	3	5	6	4	5	6	6	10	9	7	4	7	9	4	9	6	4	8	9	8	11	8	8
73	5	7	2	6	7	4	5	8	5	6	6	4	4	7	2	4	5	5	5	6	6	3	5	6	6	5	4	5	9	3

THE JUDGES' RATINGS OF THE
HANDWRITING SPECIMENS FOR
SPACING (Continued)

Specimen Nos.	Judges' Numbers																													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
74	8	6	8	8	6	9	7	7	6	7	7	6	5	4	5	7	10	6	4	7	6	6	7	7	6	6	6	6	9	6
75	9	9	11	4	8	8	11	11	11	9	9	10	11	9	8	9	7	8	11	11	10	11	9	4	9	9	11	7	8	11
76	6	6	6	10	7	5	7	4	3	5	6	5	5	5	8	8	5	4	7	5	4	7	4	4	6	6	7	6	5	6
77	6	6	8	8	11	6	5	7	7	6	7	6	7	6	6	5	6	7	6	5	6	7	8	8	9	7	3	5	6	6
78	6	11	8	9	4	5	9	7	6	8	8	6	10	6	6	8	6	5	5	7	7	7	8	5	5	8	9	8	6	8
79	6	7	10	8	7	6	6	10	7	11	5	7	7	7	7	10	10	6	6	6	7	9	5	5	9	8	8	5	5	4
80	5	8	4	9	8	4	7	5	6	5	6	7	8	5	6	7	4	8	3	7	6	8	6	9	3	7	6	7	6	6
81	2	1	2	2	6	5	2	10	4	2	1	4	1	1	3	6	1	1	2	5	5	4	2	2	2	3	6	4	1	3
82	6	4	8	5	7	9	5	9	8	4	7	9	5	7	5	4	8	10	6	8	7	3	6	9	5	4	5	3	6	6
83	5	7	4	5	4	5	6	6	7	5	8	8	2	6	5	6	6	7	6	8	8	4	7	6	7	4	3	4	5	5
84	8	9	6	11	9	7	6	9	7	8	7	6	9	9	6	7	6	6	7	9	6	8	10	7	7	10	5	6	11	6
85	3	3	4	3	6	4	2	2	3	3	4	2	6	3	3	4	4	3	3	5	4	4	2	2	2	5	4	5	3	2
86	8	9	11	5	5	8	9	10	8	9	7	7	9	10	7	8	10	11	10	9	8	6	7	5	10	8	10	4	9	8
87	4	7	3	6	9	4	5	2	6	5	6	6	6	7	2	3	4	7	3	4	6	5	4	7	5	6	5	6	4	4
88	8	5	10	8	5	7	6	5	5	7	10	5	7	7	8	7	8	10	7	9	7	9	7	6	7	10	9	9	5	5
89	9	5	6	8	6	7	4	7	6	4	5	5	8	6	5	5	5	4	4	3	4	9	4	5	4	6	5	7	7	4
90	2	2	3	6	10	3	2	4	3	2	5	4	2	6	2	4	2	3	2	2	2	2	2	3	3	2	6	3	2	4

THE JUDGES' RATINGS OF THE
HANDWRITING SPECIMENS FOR
SLANT

Specimen Nos.	Judges' Numbers																													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1	6	6	7	5	11	5	5	5	5	5	3	4	8	4	6	6	5	4	8	4	8	7	5	5	3	6	3	4	6	2
2	7	6	5	6	7	5	6	6	6	6	6	5	6	6	6	6	7	5	6	7	4	6	7	8	9	7	4	6	6	5
3	4	4	5	3	2	5	4	3	3	3	3	4	5	1	4	5	4	5	2	6	5	1	4	6	7	5	3	3	5	4
4	6	8	6	7	7	3	8	3	7	7	8	9	9	9	8	6	5	5	4	5	6	5	5	7	6	5	6	9	6	6
5	7	5	5	9	7	9	7	3	8	6	7	8	7	9	8	5	7	8	6	8	7	6	8	7	7	8	7	6	8	7
6	8	11	9	10	8	8	8	6	10	10	10	9	9	8	9	10	8	7	8	11	9	9	7	9	6	10	9	8	8	9
7	2	6	7	7	4	5	7	7	5	5	9	7	4	8	4	8	6	4	4	7	4	7	5	3	6	4	7	6	4	6
8	5	4	10	6	3	7	4	5	5	10	3	3	8	2	4	6	3	6	11	6	7	7	6	5	4	10	8	9	6	4
9	6	5	9	7	7	5	4	4	6	4	6	4	6	5	5	5	4	6	4	7	5	5	7	8	6	5	6	4	6	5
10	8	7	4	8	4	6	7	7	8	6	7	7	8	7	6	9	7	7	5	7	7	8	9	6	8	6	7	5	6	7
11	11	10	11	11	8	11	11	10	11	10	11	11	11	11	10	11	9	11	9	9	11	11	11	7	11	11	9	11	11	11
12	5	3	2	4	5	3	2	4	2	5	4	3	4	4	4	3	5	2	3	3	3	3	3	1	6	2	5	2	4	3
13	3	5	2	3	7	2	1	3	3	2	4	2	4	4	1	3	2	1	5	2	2	2	2	7	4	2	5	2	3	3
14	6	8	6	3	5	6	6	7	6	3	6	5	6	4	6	5	5	5	6	3	6	6	5	4	3	7	6	4	7	6
15	9	7	8	11	8	9	9	9	10	7	9	8	9	10	8	9	7	11	8	9	9	8	9	9	9	10	10	10	9	8
16	4	5	5	8	6	4	5	7	7	6	7	6	7	7	7	5	6	6	4	8	5	7	6	8	7	7	6	8	5	5
17	10	9	8	8	6	8	11	9	9	8	10	10	10	10	8	11	10	9	10	8	9	10	8	5	10	8	7	8	8	8
18	8	7	4	7	11	6	6	8	7	8	7	7	7	5	6	6	6	6	5	5	7	5	4	5	6	6	7	5	9	8

THE JUDGES' RATINGS OF THE
HANDWRITING SPECIMENS FOR
SLANT (Continued)

Specimen Nos.	Judges' Numbers																													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
19	4	4	6	5	9	3	6	7	2	3	7	5	3	7	6	7	5	4	4	6	6	6	4	5	7	3	8	5	7	7
20	4	6	4	4	3	4	4	5	6	7	6	6	7	5	7	4	3	4	4	7	4	4	4	7	7	5	5	5	6	4
21	5	3	3	8	3	8	6	4	4	4	6	6	7	4	5	6	10	9	6	4	6	7	5	3	1	4	3	7	2	4
22	8	7	10	6	8	6	10	9	9	11	9	9	11	7	9	8	9	8	8	8	9	8	10	8	7	7	7	8	9	
23	9	11	7	9	8	10	10	8	8	8	9	9	9	8	7	6	8	7	10	10	10	8	11	8	10	8	8	10	10	10
24	4	3	3	4	6	2	1	2	1	5	6	5	3	3	1	2	2	3	1	1	2	1	3	6	5	2	3	4	1	5
25	7	8	7	8	9	6	6	7	7	10	7	8	6	8	7	6	7	7	9	6	8	7	8	8	9	8	8	9	8	8
26	7	5	7	6	8	5	4	4	4	4	5	6	6	5	5	6	5	6	7	3	6	6	6	4	5	7	5	6	5	6
27	8	7	6	9	7	9	9	8	10	7	8	10	8	8	8	7	8	7	8	9	11	10	8	8	7	8	8	7	7	9
28	8	11	8	6	8	8	8	5	8	9	6	8	10	7	11	9	7	9	8	6	6	8	9	6	8	9	9	9	11	7
29	8	6	11	9	8	8	8	8	7	6	5	7	9	6	11	7	9	9	9	7	9	7	10	5	6	8	5	9	8	7
30	3	4	4	5	5	1	2	5	6	2	6	6	3	6	3	2	2	1	3	6	3	4	2	6	5	3	5	3	3	3
31	7	7	5	6	7	7	8	9	11	7	8	9	10	9	8	10	5	4	7	6	6	8	7	11	8	7	9	10	9	7
32	8	8	5	7	7	6	8	6	8	9	10	8	4	7	7	7	8	5	5	7	8	8	7	10	6	6	10	7	7	7
33	11	9	9	10	6	10	11	11	9	9	9	11	10	11	10	10	11	9	9	11	11	11	11	8	10	8	9	11	10	11
34	9	9	8	6	10	7	6	7	8	3	9	7	8	8	10	7	11	8	9	4	9	8	10	8	8	7	6	6	7	8
35	6	5	5	5	4	5	3	6	4	4	4	3	3	6	4	5	4	6	5	4	4	4	4	4	4	6	6	3	5	6
36	2	7	6	7	9	4	6	6	7	9	8	6	4	7	7	6	3	5	4	6	2	6	5	10	6	7	4	6	6	7

THE JUDGES' RATINGS OF THE
HANDWRITING SPECIMENS FOR
SLANT (Continued)

Specimen Nos.	Judges' Numbers																													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
37	1	2	2	1	1	5	3	3	1	1	2	1	1	1	5	3	1	2	3	2	4	2	3	3	3	2	1	1	2	3
38	1	1	1	1	3	1	1	1	2	1	1	1	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
39	3	6	6	6	6	6	6	6	6	9	6	4	7	7	4	6	5	6	3	4	3	5	3	7	6	4	8	6	7	8
40	6	7	6	4	6	7	6	6	4	6	5	4	5	5	5	5	7	6	9	4	7	3	4	6	4	6	6	6	5	5
41	6	6	8	7	5	7	7	7	5	7	5	6	5	5	5	9	7	6	7	3	9	6	6	3	5	9	7	6	5	5
42	10	10	8	10	5	8	9	9	8	8	8	11	9	9	9	8	9	10	8	6	9	10	7	11	9	10	7	9	9	9
43	7	9	5	6	6	6	7	7	6	8	7	10	8	8	6	7	5	6	6	8	6	8	8	10	9	10	8	9	7	6
44	5	6	4	4	6	4	5	5	6	3	4	3	5	5	6	3	3	4	5	5	3	4	4	4	7	4	4	4	4	4
45	5	8	7	2	6	6	6	6	5	6	5	5	6	6	5	7	5	3	5	3	4	5	3	5	5	5	6	4	7	5
46	5	2	5	3	3	6	4	4	4	4	2	5	3	3	5	4	5	4	5	5	5	4	6	4	4	3	3	3	5	4
47	5	6	8	6	9	6	5	5	5	5	6	6	5	5	2	5	6	6	7	5	6	4	6	6	2	6	6	4	7	5
48	11	10	10	11	9	11	10	10	11	11	10	9	11	11	9	11	8	10	11	11	7	11	8	11	10	11	11	11	9	10
49	7	6	6	7	9	3	5	5	6	8	8	7	7	7	6	6	6	3	6	7	4	7	8	6	6	5	6	7	6	7
50	6	6	7	6	5	5	5	5	5	5	5	5	5	5	7	4	5	3	5	6	5	6	6	5	6	7	5	3	6	3
51	9	7	9	8	7	9	8	8	8	6	7	7	8	8	11	8	8	8	7	8	7	9	8	7	6	6	9	7	9	9
52	9	8	9	9	6	7	7	7	9	8	8	9	6	6	10	8	10	10	7	10	8	8	9	3	9	9	8	8	6	11
53	10	8	8	9	7	7	9	9	10	11	11	9	7	7	9	10	8	9	7	10	10	10	9	7	11	9	11	7	7	10
54	2	2	3	2	1	1	2	2	2	1	4	3	2	2	3	2	3	2	1	6	1	3	1	2	2	3	1	1	3	3

THE JUDGES' RATINGS OF THE
HANDWRITING SPECIMENS FOR
SLANT (Continued)

Specimen Nos.	Judges' Numbers																													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
55	5	4	1	5	4	4	3	3	5	5	1	1	5	3	5	3	4	7	7	2	5	5	4	6	5	3	4	6	3	2
56	3	1	4	3	2	5	5	4	3	4	1	2	6	4	3	4	4	5	4	3	5	3	3	2	1	5	2	5	2	1
57	6	4	6	7	7	7	5	7	7	6	5	7	4	7	7	6	6	5	5	8	7	7	5	9	7	6	6	4	6	6
58	6	5	10	6	4	9	8	9	5	6	5	7	8	5	5	9	10	8	10	5	10	6	10	4	5	8	5	10	11	7
59	7	8	8	7	6	10	7	5	9	7	7	6	5	7	8	7	7	7	8	7	8	6	7	8	9	9	5	5	7	8
60	4	5	4	6	6	2	5	7	5	4	8	6	8	6	7	4	7	7	5	7	3	9	8	9	5	1	6	8	4	7
61	4	4	3	5	5	4	4	1	3	4	5	3	4	6	3	3	4	5	3	6	3	3	1	2	4	4	2	2	3	5
62	6	10	5	5	5	6	7	5	5	6	3	6	6	6	5	8	6	8	7	6	6	5	7	4	7	6	6	8	10	8
63	4	3	3	3	4	5	3	6	4	5	4	3	4	3	3	1	5	5	3	2	5	2	5	1	3	3	2	5	3	4
64	4	6	4	4	5	4	3	4	6	5	5	5	4	5	6	5	4	5	6	6	5	4	6	3	6	4	4	5	6	6
65	5	6	4	5	9	4	6	2	6	3	6	5	6	7	2	4	3	3	2	6	1	4	4	7	5	4	7	3	6	3
66	6	6	7	4	5	6	6	4	6	6	4	6	5	6	7	7	4	6	5	5	5	4	5	6	6	6	4	7	4	5
67	7	8	6	7	6	4	4	6	6	5	5	5	6	5	8	7	8	7	6	5	6	5	6	7	4	6	6	7	8	7
68	7	6	6	6	10	5	9	8	7	7	7	8	6	5	9	5	8	3	7	8	8	7	6	9	7	3	8	8	5	8
69	8	9	3	5	3	10	10	6	7	8	6	5	5	6	4	8	8	6	9	7	8	7	6	6	7	5	9	5	8	10
70	6	5	9	8	10	7	6	5	5	6	4	6	7	5	6	7	7	8	7	4	7	7	6	5	3	5	3	5	8	6
71	9	7	5	9	7	7	7	9	9	7	9	10	9	7	6	8	9	8	7	9	8	7	9	9	9	7	7	9	7	6
72	9	7	7	10	8	11	9	10	7	8	11	8	6	9	8	9	11	8	8	10	7	9	7	11	8	7	11	8	9	9

THE JUDGES' RATINGS OF THE
HANDWRITING SPECIMENS FOR
SLANT (Continued)

Specimen Nos.	Judges' Numbers																													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
73	3	6	5	5	4	3	4	5	6	4	6	6	7	5	6	6	4	6	4	3	4	5	6	6	5	4	5	5	4	5
74	5	3	9	4	4	9	7	5	4	5	6	4	3	2	6	5	6	7	6	5	7	6	6	6	5	6	4	6	2	6
75	10	8	11	8	5	9	9	9	9	8	7	8	8	8	9	9	7	11	11	9	10	10	9	9	8	11	10	6	10	9
76	8	9	6	8	11	7	7	10	8	7	8	8	6	8	8	9	9	10	7	6	6	6	7	7	6	9	8	7	8	6
77	7	5	7	5	6	6	5	6	4	5	3	5	5	3	4	6	7	5	6	4	4	6	6	6	5	5	3	3	5	4
78	6	9	7	4	7	6	8	7	7	7	5	7	6	5	7	7	6	6	6	7	5	6	7	4	7	8	7	8	4	8
79	6	4	7	3	2	7	5	6	3	6	2	4	1	2	1	6	6	7	6	5	6	5	4	5	3	6	5	5	3	5
80	3	7	6	7	4	5	7	7	8	4	7	7	6	9	7	4	6	4	6	9	6	6	5	7	8	7	7	6	6	6
81	2	1	1	1	1	3	3	2	1	2	2	2	1	1	3	2	1	2	3	1	3	2	2	2	3	1	5	2	1	2
82	5	2	7	7	3	8	6	3	5	6	6	7	7	4	5	5	9	8	6	5	7	8	7	4	2	4	2	8	5	5
83	7	5	6	8	6	7	5	8	7	7	7	7	7	8	4	4	6	6	5	8	3	4	7	6	8	6	6	6	7	7
84	7	7	5	4	4	8	7	8	7	9	4	5	4	6	6	4	6	10	7	9	8	5	7	3	8	8	7	6	5	6
85	4	5	4	2	10	4	3	4	4	2	3	4	3	6	6	3	3	4	2	6	3	5	3	6	2	4	4	4	4	1
86	5	4	8	5	2	8	8	6	4	6	4	5	7	2	2	8	6	7	6	5	9	6	6	5	4	5	6	7	5	4
87	3	4	3	6	6	3	5	6	6	7	6	4	6	6	5	4	4	4	6	4	5	4	5	5	4	6	4	4	4	6
88	5	3	6	6	5	8	6	5	3	3	5	4	2	3	4	7	6	7	8	4	6	5	5	5	4	5	7	6	6	4
89	6	5	6	5	8	6	4	6	6	9	8	6	5	6	7	5	6	5	4	6	4	6	5	8	7	7	5	7	5	6
90	1	3	2	2	5	2	2	2	3	5	3	2	2	4	3	1	2	3	2	5	2	3	2	4	5	5	4	5	4	2

THE JUDGES' RATINGS OF THE
HANDWRITING SPECIMENS FOR
LEGIBILITY

Specimen Nos.	Judges' Numbers																													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1	5	5	5	5	7	3	5	2	5	6	3	7	8	2	4	3	2	3	5	5	5	5	6	3	4	4	5	3	5	2
2	6	9	6	6	7	6	6	7	8	7	8	6	7	6	6	7	8	6	7	6	5	7	8	6	7	7	3	6	8	7
3	6	4	6	5	10	6	5	5	5	5	5	5	3	4	5	4	5	5	5	4	4	4	5	3	6	5	8	5	5	6
4	3	5	3	4	5	3	4	4	3	4	6	3	5	6	4	2	3	5	4	3	5	3	4	2	3	3	5	7	3	4
5	7	7	7	10	3	10	7	7	7	8	6	5	5	9	5	7	7	8	5	10	7	7	7	3	5	7	4	5	6	6
6	9	9	8	11	6	8	9	6	8	11	10	8	9	9	10	10	6	8	9	10	7	9	8	10	10	11	8	10	8	9
7	6	8	6	6	7	5	6	6	6	7	9	10	8	6	6	9	4	6	4	5	5	7	5	8	7	6	7	6	6	5
8	6	5	9	5	6	7	4	6	7	9	3	4	8	5	5	4	5	4	9	9	7	8	6	8	6	6	7	9	5	2
9	6	6	5	6	4	5	5	5	5	4	5	5	5	5	5	6	7	6	6	7	3	5	6	6	5	5	6	5	6	7
10	8	5	4	8	5	6	7	4	7	5	6	7	6	3	4	6	4	3	5	8	7	3	6	1	2	4	9	3	6	6
11	11	11	11	5	8	11	11	9	8	9	11	8	10	11	10	10	11	11	10	9	11	11	11	7	9	8	10	11	9	11
12	4	4	4	4	8	3	1	2	2	2	4	1	6	4	3	2	4	3	3	4	3	3	3	5	4	5	6	3	2	4
13	3	5	4	4	6	4	3	4	4	2	5	3	3	4	3	4	3	3	4	2	3	3	3	4	3	5	3	5	3	3
14	4	6	8	8	7	7	5	6	7	6	6	8	8	5	11	6	5	7	6	6	5	8	5	10	6	7	7	6	9	5
15	9	9	7	11	9	7	8	7	11	10	10	9	6	10	8	9	9	10	11	10	8	8	10	6	10	9	11	9	11	9
16	5	6	5	3	5	3	6	5	5	3	8	3	5	5	4	5	5	3	4	6	4	4	4	8	4	5	6	5	3	7
17	6	7	7	6	5	4	10	10	6	9	8	11	7	7	8	8	6	7	9	7	8	8	6	5	6	5	4	7	6	6
18	9	7	6	9	7	7	7	7	8	7	7	7	8	8	9	5	7	6	6	6	7	9	7	10	8	6	8	7	9	6

THE JUDGES' RATINGS OF THE
HANDWRITING SPECIMENS FOR
LEGIBILITY (Continued)

Specimen Nos.	Judges' Numbers																													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
19	3	6	4	2	4	4	6	5	3	4	5	5	5	5	5	7	6	4	4	4	6	6	6	5	5	3	5	5	3	6
20	4	6	4	4	2	5	5	3	7	3	5	6	7	6	3	6	4	4	3	4	5	5	4	8	5	4	7	5	4	5
21	7	5	6	8	5	9	6	6	6	7	5	6	4	6	9	5	7	9	6	5	8	7	9	5	8	6	6	6	4	4
22	4	2	6	1	2	2	5	8	3	5	6	4	6	4	3	5	3	4	5	4	6	2	2	6	3	3	3	7	5	8
23	8	9	7	7	11	7	8	9	8	5	9	10	10	7	4	7	7	7	8	9	9	7	11	7	5	7	7	9	10	8
24	2	2	5	2	8	2	3	2	2	1	2	4	2	2	2	1	1	1	2	1	1	1	2	2	3	1	4	2	1	1
25	6	9	5	7	6	8	7	8	9	9	8	7	9	8	7	5	6	7	8	8	7	7	8	6	7	9	8	7	8	4
26	9	6	8	7	7	6	7	7	7	7	6	7	7	8	6	6	6	9	9	6	7	5	7	10	9	6	9	6	6	10
27	8	8	7	6	7	7	7	6	6	6	7	10	6	4	5	7	8	5	10	6	10	8	7	8	6	7	6	7	7	6
28	8	11	9	11	6	11	9	9	10	11	9	8	10	10	9	11	11	8	11	11	6	10	8	11	11	7	10	8	11	9
29	10	6	10	8	9	9	8	10	9	8	7	9	9	10	10	6	9	7	8	6	10	10	9	9	7	10	9	9	10	8
30	1	2	1	3	1	1	2	1	1	2	3	1	2	1	1	1	1	2	2	4	2	2	3	1	2	2	2	2	1	3
31	5	3	6	5	3	6	7	7	5	9	6	6	10	6	6	11	6	6	6	8	6	6	4	6	3	4	6	9	8	7
32	6	6	4	5	4	5	6	8	6	8	9	5	6	6	5	7	6	6	5	7	6	6	9	6	6	9	8	11	6	6
33	11	7	10	3	11	8	8	8	6	7	7	7	9	8	11	7	8	10	8	9	11	7	8	7	4	7	4	10	7	11
34	7	8	8	8	4	6	6	6	5	5	7	9	4	7	7	6	6	6	6	6	9	6	10	7	7	7	5	6	4	8
35	5	3	5	5	2	6	4	4	4	4	5	5	3	7	6	4	7	4	5	5	5	6	5	6	6	5	4	4	5	6
36	4	5	6	5	5	4	4	5	8	5	6	5	4	6	5	6	5	5	2	2	5	6	4	7	4	3	7	6	6	5

THE JUDGES' RATINGS OF THE
HANDWRITING SPECIMENS FOR
LEGIBILITY (Continued)

Specimen Nos.	Judges' Numbers																													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
37	2	5	5	5	3	5	3	3	3	6	5	4	3	4	5	3	4	5	4	2	5	4	4	3	2	5	2	4	4	4
38	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
39	4	6	5	4	4	6	6	7	5	8	5	6	7	3	5	6	5	5	5	5	3	7	4	3	6	3	6	4	8	9
40	7	5	6	9	5	6	6	7	7	7	6	6	5	9	6	6	6	7	8	7	6	5	8	9	8	7	9	6	6	6
41	7	10	7	7	8	8	8	6	8	7	7	8	6	9	6	7	8	9	8	7	6	6	7	9	8	10	10	6	8	8
42	8	8	10	7	6	9	9	8	7	8	11	8	9	7	8	8	8	8	8	8	9	7	9	6	7	8	5	8	7	8
43	7	10	10	10	6	6	9	7	9	7	8	11	8	10	8	8	6	7	7	8	7	8	7	11	11	10	8	7	8	10
44	6	6	4	6	3	5	4	8	5	4	4	4	2	5	3	4	5	5	6	6	4	4	4	5	7	5	5	6	5	5
45	6	7	7	8	5	7	5	8	6	6	7	5	6	6	7	8	5	6	6	5	4	7	5	9	9	6	7	5	7	6
46	5	4	6	6	4	7	6	6	9	6	3	5	4	7	9	6	7	6	6	7	8	7	6	5	4	7	6	4	6	4
47	7	7	9	6	7	7	6	7	10	10	7	6	8	8	9	9	8	7	7	8	9	8	7	7	6	7	6	8	10	6
48	10	11	11	7	8	11	11	11	11	11	9	6	11	11	8	11	7	11	10	11	7	11	5	11	10	11	11	11	8	8
49	5	6	5	4	5	5	4	8	4	3	4	5	6	5	4	5	5	3	5	6	4	3	5	9	5	5	5	7	3	6
50	7	8	6	7	10	6	5	4	8	5	5	6	7	7	6	6	6	4	7	6	6	6	6	6	8	8	4	6	5	5
51	8	7	7	6	5	10	9	6	6	5	7	6	7	6	7	9	10	6	9	9	5	8	8	8	9	6	9	8	9	8
52	8	8	6	9	5	8	7	9	7	8	6	8	6	9	9	7	11	9	7	9	8	4	8	3	8	7	6	8	6	8
53	9	8	6	6	11	8	8	9	7	10	11	8	6	7	5	9	8	8	7	6	10	10	9	8	6	8	8	9	7	10
54	1	3	1	2	2	2	1	1	3	1	3	2	1	2	2	2	3	1	1	3	1	1	2	4	1	1	1	1	2	1

THE JUDGES' RATINGS OF THE
HANDWRITING SPECIMENS FOR
LEGIBILITY (Continued)

Specimen Nos.	Judges' Numbers																														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	
55	6	4	3	6	1	6	2	6	5	6	2	3	4	3	8	4	5	7	7	3	6	6	3	9	5	4	5	5	4	3	
56	5	4	5	4	9	6	7	4	5	6	2	7	6	5	4	5	6	4	5	5	5	6	6	5	7	6	6	6	5	4	
57	4	3	4	7	6	4	3	5	4	5	5	4	6	5	5	4	5	5	5	6	6	5	5	4	5	4	5	3	4	5	
58	9	7	11	8	9	7	8	10	8	6	7	9	11	8	9	8	8	10	8	7	9	6	11	4	5	8	5	10	7	11	
59	11	10	8	9	8	9	10	7	10	9	8	9	9	9	7	9	10	10	9	9	8	9	8	8	11	10	9	6	9	9	
60	3	1	3	1	4	1	6	5	1	3	5	3	4	4	2	8	5	2	6	4	4	2	1	4	1	2	2	7	5	3	
61	4	5	3	3	5	5	4	4	4	6	5	6	4	3	6	4	2	4	3	5	3	2	3	5	5	5	3	3	4	2	
62	6	6	6	5	10	4	6	5	5	5	4	4	7	6	8	5	7	7	6	5	6	5	5	5	6	6	3	6	4	9	
63	2	3	5	6	6	3	3	3	4	3	3	6	3	4	6	3	4	2	4	5	3	5	6	4	7	4	6	2	6	3	
64	6	7	5	4	8	5	4	5	3	3	7	5	5	4	7	4	4	5	5	3	4	5	5	4	5	5	6	5	5	5	
65	5	4	3	5	7	5	6	4	4	6	4	4	6	5	6	6	4	4	3	2	2	4	5	5	4	6	6	4	5	4	
66	6	7	7	6	7	7	5	5	6	7	4	3	7	5	6	6	7	6	6	3	6	6	5	6	7	9	6	7	6	7	
67	7	8	8	10	7	6	7	6	9	7	8	7	7	7	8	8	9	6	7	6	6	9	7	9	9	7	8	8	10	7	7
68	4	4	3	3	4	5	6	4	4	5	3	4	5	5	7	3	6	4	4	3	6	4	4	8	5	4	3	7	3	5	
69	8	9	7	6	3	7	10	9	10	8	10	7	9	8	7	7	10	7	8	7	10	5	7	5	8	8	5	8	7	10	10
70	5	3	9	9	6	8	5	6	5	4	6	6	7	7	10	9	7	9	6	7	7	9	6	7	4	8	4	5	9	7	7
71	8	8	4	8	6	6	8	5	6	6	9	5	4	6	6	5	9	7	6	4	9	10	8	6	6	6	6	6	5	7	7
72	10	7	8	6	6	10	9	11	7	9	9	7	8	8	8	7	8	8	7	11	9	7	9	7	6	6	7	10	8	8	8

THE JUDGES' RATINGS OF THE
HANDWRITING SPECIMENS FOR
LEGIBILITY (Continued)

Specimen Nos.	Judges' Numbers																														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	
73	3	6	2	4	3	3	3	3	2	3	4	2	5	4	2	2	2	6	3	4	4	5	3	2	2	2	5	3	2	5	
74	7	5	8	7	9	9	7	6	6	4	6	9	6	7	6	6	9	7	7	5	6	5	7	6	9	5	7	7	7	6	
75	9	6	9	10	8	10	11	11	7	10	8	10	11	11	8	8	10	11	11	10	8	11	10	8	8	11	10	9	8	9	
76	8	9	5	7	7	8	7	7	9	6	8	11	6	8	7	5	9	8	7	7	11	8	9	6	10	8	8	7	7	7	
77	7	5	8	8	5	7	4	6	7	6	4	7	4	7	5	5	6	6	6	7	6	6	6	6	6	6	7	5	6	5	
78	5	8	4	8	9	4	8	8	4	8	10	8	4	6	7	6	5	6	7	8	5	4	6	6	6	6	9	8	6	4	7
79	7	4	9	9	6	9	8	6	6	6	4	6	7	7	7	10	8	8	9	8	8	9	6	7	8	9	7	4	9	6	
80	5	6	3	5	4	4	5	3	6	5	6	8	5	3	4	8	4	5	4	8	8	4	5	7	4	4	5	5	6	5	
81	3	2	2	3	6	4	3	3	4	2	1	3	1	1	3	3	3	2	3	1	2	3	2	4	5	3	2	2	2	3	
82	5	3	7	5	4	6	5	5	11	5	6	5	8	6	6	5	7	9	7	5	7	7	7	5	7	6	4	7	6	5	
83	6	4	6	7	10	5	5	8	6	7	6	7	3	3	4	5	3	6	5	7	5	5	6	3	7	6	4	4	5	6	
84	10	6	8	7	6	8	9	9	8	7	8	7	7	9	7	8	6	9	10	8	7	8	10	7	8	8	11	4	7	7	
85	4	1	6	4	8	5	2	3	5	4	1	4	3	3	4	4	4	3	2	4	2	6	1	2	3	4	3	3	7	2	
86	7	10	9	7	8	9	10	7	6	8	6	9	8	8	11	10	9	8	8	6	7	9	7	7	9	8	9	8	11	7	
87	3	5	2	3	6	3	4	5	2	4	7	2	5	5	3	3	3	5	4	4	4	4	3	4	3	3	4	4	4	4	
88	5	7	7	9	9	8	7	10	6	8	7	6	5	6	6	7	7	8	6	7	8	6	7	5	7	9	7	8	7	7	
89	6	7	7	6	7	4	6	4	9	6	4	6	5	6	7	7	6	5	3	6	4	6	6	7	6	6	7	4	7	4	
90	2	4	2	2	3	2	2	2	3	4	2	2	2	2	1	3	2	5	1	3	3	3	4	4	4	4	2	1	1	3	3

APPENDIX C

THE JUDGES' AVERAGE RATINGS OF
THE HANDWRITING SPECIMENS

THE JUDGES' AVERAGE RATINGS OF
THE HANDWRITING SPECIMENS

Specimen No.	General Appearance	Letter Formation	Spacing	Slant	Legibility	Grand Mean
1	3.5000	5.0333	5.2333	5.3667	4.4000	4.7067
2	5.7000	6.1000	6.6000	6.0667	6.6333	6.2200
3	4.1000	4.5000	4.9333	3.9333	5.1333	4.5200
4	4.9333	4.7333	5.3667	6.3333	3.9333	5.0600
5	6.5667	6.8333	6.2667	7.0000	6.5667	6.6467
6	8.1667	8.5000	7.4667	8.7000	8.8000	8.3267
7	5.8333	6.0333	7.2667	5.6000	6.4000	6.2267
8	6.1333	7.1667	6.3333	5.9000	6.1333	6.3333
9	5.7333	5.0000	5.8000	5.5333	5.4000	5.4933
10	4.9667	7.0000	4.6333	6.8000	5.2667	5.7333
11	10.3333	9.7667	9.8333	10.3667	9.7667	10.0133
12	3.1667	3.2000	3.1667	3.4000	3.5333	3.2933
13	3.2667	3.0333	4.3667	3.0333	3.6000	3.4600
14	5.8000	6.4667	6.0000	5.3667	6.6667	6.0600
15	8.9000	8.3333	8.2333	8.8667	9.0333	8.6733
16	5.1000	4.4000	4.8000	6.1333	4.8000	5.0467
17	8.4667	8.6000	5.7667	8.7667	6.9667	7.7133
18	6.3667	6.3000	6.8333	6.4667	7.3333	6.6600
19	5.3000	4.9000	6.0000	5.3667	4.7000	5.2533
20	4.7333	5.0000	4.0667	5.0333	4.7667	4.7200
21	7.1667	7.1667	7.8000	5.1000	6.3333	6.7133
22	7.3333	6.2333	5.3000	8.3667	4.2333	6.2933
23	7.4667	7.7667	8.1667	8.8000	7.9000	8.0200
24	1.9000	1.9000	3.5333	3.0000	2.1667	2.5000
25	6.7667	7.1667	7.7000	7.5667	7.2667	7.2933
26	6.8667	6.9667	5.8000	5.4667	7.2000	6.4600
27	6.9667	7.2667	7.0667	8.1333	6.9333	7.2733
28	8.9000	9.1667	8.7000	8.0667	9.4667	8.8600
29	8.1000	8.4667	9.0333	7.7333	8.6333	8.3933
30	2.1000	2.0333	2.8000	3.7333	1.7667	2.4867

THE JUDGES' AVERAGE RATINGS OF
THE HANDWRITING SPECIMENS (Continued)

Specimen No.	General Appearance	Letter Formation	Spacing	Slant	Legibility	Grand Mean
31	6.3333	6.9333	5.8333	7.7333	6.2000	6.6067
32	6.8667	6.1667	6.5000	7.2000	6.4333	6.6333
33	9.7667	9.4333	6.8667	9.8667	7.9667	8.7800
34	7.3333	6.6667	6.7000	7.7000	6.5533	6.9867
35	4.6333	4.2333	5.5000	4.5667	4.8333	4.7533
36	4.8000	5.0000	5.8000	5.9333	5.0000	5.3067
37	3.6000	3.7000	4.2000	2.1667	3.8667	3.5067
38	1.1333	1.1667	1.1667	1.2333	1.0000	1.1400
39	5.2333	5.0667	5.6000	5.6333	5.3333	5.3733
40	6.4000	6.3333	6.4333	5.4667	6.7000	6.2667
41	7.7000	7.3333	7.1667	6.0667	7.6333	7.1800
42	8.2000	7.8333	7.9667	8.6667	7.9000	8.1133
43	7.8000	7.4667	7.5333	7.3667	8.3000	7.6933
44	4.9000	5.0333	4.8000	4.5667	4.8333	4.8267
45	5.6000	5.4000	5.5333	5.1333	6.3667	5.6067
46	5.6000	5.3333	6.1667	4.2000	5.8667	5.4333
47	6.9667	7.1333	7.5667	5.4333	7.5667	6.9333
48	10.2000	10.3333	9.3000	10.1667	9.6667	9.9333
49	5.9333	5.3333	5.5667	6.3333	4.9667	5.6267
50	5.4000	5.5333	4.8000	5.2333	6.2000	5.4333
51	7.5333	7.4333	7.5000	7.9333	7.4333	7.5667
52	8.0000	7.7667	7.3000	8.1667	7.4000	7.7267
53	9.0333	8.2667	8.4667	9.0000	8.0667	8.5667
54	1.9333	1.6333	1.8667	2.3000	1.7333	1.8933
55	4.5333	4.4000	3.7000	4.0000	4.7000	4.2667
56	4.8333	5.0000	5.0333	3.3000	5.3333	4.7000
57	5.1000	4.8667	4.5667	6.1667	4.7000	5.0800
58	9.000	9.2000	7.6000	7.2000	8.1333	8.2267
59	7.8333	8.7667	7.8000	7.1667	8.9000	8.0933
60	4.0667	4.9000	4.1667	5.7667	3.4000	4.4600

THE JUDGES' AVERAGE RATINGS OF
THE HANDWRITING SPECIMENS (Continued)

Specimen No.	Appearance	Formation	Spacing	Slant	Legibility	Grand Mean
61	3.1667	3.3667	3.9333	3.6000	4.0000	3.6133
62	6.2000	5.9000	5.0333	6.2667	5.7333	5.8267
63	3.7000	3.4333	3.8000	3.5333	4.1333	3.7200
64	5.2000	5.0667	5.0000	4.8333	4.9333	5.0067
65	3.6667	4.2333	4.1667	4.6000	4.6000	4.2533
66	5.5333	5.7000	4.9333	5.4333	6.0333	5.5267
67	6.9333	6.7667	6.5333	6.1000	7.6000	6.7867
68	5.6000	5.4333	4.8667	6.8667	4.5000	5.4533
69	7.9333	8.2000	6.9000	6.7000	7.6667	7.4800
70	6.8000	6.3667	7.2000	6.1000	6.6667	6.6267
71	7.0667	7.3333	7.8667	7.8667	6.5000	7.3267
72	8.1333	8.8667	6.9667	8.6667	8.0333	8.1333
73	4.4000	4.2667	5.1667	4.9000	3.3000	4.4067
74	6.8667	6.3667	6.6000	5.3000	6.7000	6.3667
75	9.4667	9.2333	9.1000	8.8333	9.3667	9.2000
76	6.9333	7.1000	5.8333	7.7333	7.7000	7.0600
77	5.3333	5.3333	6.5333	5.1333	5.9667	5.6600
78	6.1000	5.8333	7.0333	6.4667	6.4667	6.3800
79	7.2000	6.7333	7.1333	4.5333	7.2333	6.5667
80	5.3000	5.6000	6.2000	6.3333	5.1333	5.7133
81	2.3667	2.3667	3.1000	1.9333	2.7000	2.4933
82	6.4000	6.1333	6.2667	5.5333	6.0333	6.0733
83	5.5667	5.6667	5.6333	6.5000	5.4667	5.7667
84	7.1333	6.6333	7.6000	6.2333	7.8000	7.0800
85	3.4000	3.2333	3.4333	3.9333	.35667	3.5133
86	7.5000	8.4000	8.1667	5.5000	8.2000	7.5533
87	4.8333	4.2667	5.0333	4.8333	3.8333	4.5600
88	7.1333	6.6667	7.2667	5.1000	7.0667	6.6467
89	4.8333	4.7000	5.5667	5.9667	5.8000	5.3733
90	2.4000	2.1000	3.2667	3.0000	2.5667	2.6667

APPENDIX D
HANDWRITING SPECIMENS

THE BEST HANDWRITING SPECIMENS

The quick brown fox jumps over the lazy dog.

The quick brown fox jumps over the lazy dog.

The quick brown fox jumps over the lazy dog.

THE POOREST HANDWRITING SPECIMENS

30.

The quick brown dog jumps over the lazy dog.

51.

The quick brown fox jumps over the lazy dog.

38.

The quick brown fox jumps over the lazy dog.

B29884